

GIANTS OF THE NORTH AMERICAN PLEISTOCENE

by John P.

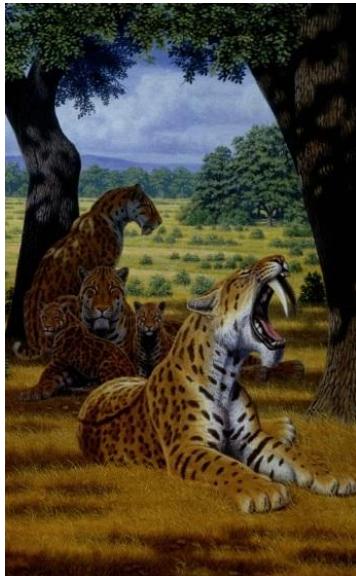


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ENVIRONMENTS

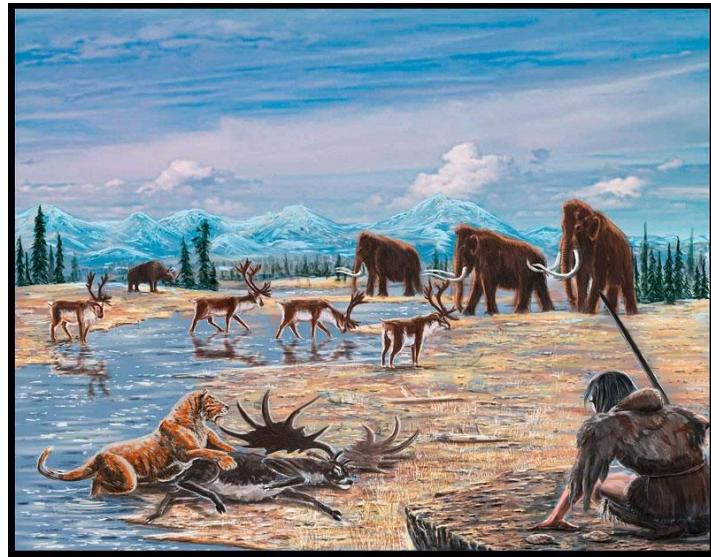
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PLEISTOCENE: DEFINED

2

The Pleistocene is an epoch (segment of time), named by geologists and paleontologists to describe a time period from 2.5 million years ago until 0.0118 million years ago. The Pleistocene was preceded by the Pliocene and succeeded by the Holocene of today. To give context, the dinosaurs went extinct 62.5 million years before the beginning of the Pleistocene, wolves were on their way to becoming dogs, the first signs of organized labor had already begun before the end of the Pleistocene. Most plants and animals alive today evolved during or before the Pleistocene, and those that didn't have ancestors which would be highly recognizable. Unfortunately, very few of the existent fauna are large enough to be included in this list, though they were present and oftentimes abundant during this epoch. Major geographical landmarks such as rivers, lakes, hills, and mountains of the Pleistocene have changed imperceptibly, save for what humans have remolded.

During the Pleistocene, North America and Asia were connected by a land bridge from Alaska to Russia, called Beringia. About 3-5 million years ago North and South America connected, via a volcano which rose from the ocean floor. This enabled South America to exchange animal and plant life with other continents for the first time in 107.5 million years. This meant that North America was the melting pot for African, Eurasian, South American, as well as the indigenous North American animals, creating a fiercely competitive environment, and giving rise to fantastically huge, adaptable, and in many cases more aggressive megafauna than anything alive today.

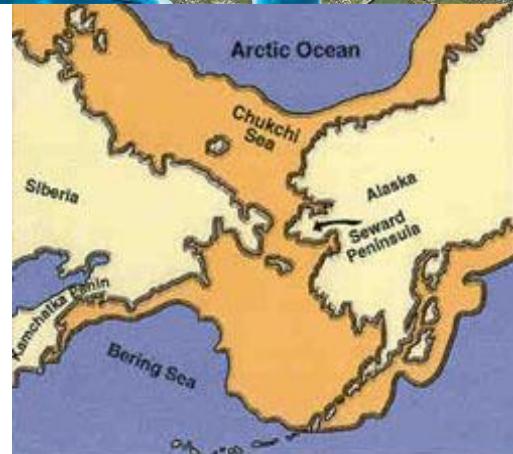


GLACIERS

3

The interconnectedness of the continents caused a new issue, however: the ice age. The ocean pumped warm water between North and South America before North and South America connected 5 million years ago, this caused a huge disruption in the oceanic currents, cooling the northern hemisphere. The current ice age began approximately 2.6 million years ago and has yet to end, as there is still ice which survives frozen year-round (glaciers).

During the last glacial maximum (about 24,000 years ago), the Laurentide (east of the rockies) and the Cordilleran (west of the rockies) Ice Sheets covered much of northern North America, in some places by up to 3 miles, or 15,840 feet of ice. Taking water from not only the ocean, but also the world's freshwater supply, creating a world with significantly less precipitation, and therefore less lush than today. This '*missing*' water lowered the sea levels by nearly 500 feet, exposing the seabed between Siberia and Alaska allowing terrestrial animals from eurasia and north america to cross, allowing for genetic drift to create a unique north american megafaunal ecosystem. The glaciers also helped to alter the ecosystem by bringing minerals from the north, down south. They also changed the landscape, building hills and valleys as the ocean of ice ground itself across the continent. The ice sheets left only a narrow pathway through the Canadian Rockies to the southern half of the continent for parts of the Pleistocene.



DESERT

4

Deserts have the lowest biomass per acre of any ecosystem. They are defined by having a higher evaporation rate than precipitation, which means no bodies of water increase in size year over year in deserts. They are characterized by their lack of flora due to the lack of precipitation. Poor soil and sparse or short flora makes up deserts, ranging from totally barren to almost approaching bush or grassland. Because of this, some of the most extreme and unique adaptations have evolved to cope with the extreme heat and to retain water. Many desert animals can live their entire lives without drinking water, because it is the primary ecological pressure. This is because, due to ecological restrictions, the ability to store water and regulate temperature are more valuable than speed, stealth or strength.

Though there are fruiting plants in the desert, fruits are so costly they often are poisonous because desert flora doesn't use scat seed dispersal as reliably as in other biomes. Desert flora also evolves thorns to discourage herbivores which they cannot support due to the extreme lack of water slowing regeneration of biomass. Where there is water, the desert explodes into life, being a center for migratory birds and a breeding ground for many desert residents. To avoid the sun, almost all animals are exclusively nocturnal, this is because the surface of a desert can be hot enough to cause cellular damage to most animals, even through fur or thick skin.



TUNDRA

5

The infamous tundra. Just south of the glaciers, it was an open environment with flowering, nutrient rich plants carpeting the ground (but for just 4-7 months a year), rarely reaching above one foot in height. These plains were well watered by snow melt and rains, and were remarkably fertile during the short summer. Unlike today's tundra, the tundra of the pleistocene being further south, received more solar energy than the tundra of today at its extremely high longitude. This enabled the plants that were there to make the most out of the summer months, and to grow fast enough to support the complex ecosystems of the time. The melt waters meant there was always abundant water, whether it rained or not, further enabling the rapid growth of small plants.

However, these open, fertile plains were also often hit by major floods which came from glaciers melting to form lakes behind ice dams. When these broke, hundreds and sometimes thousands of square miles were shaped by the torrent of water so powerful it carved rocky mountains to form the Scablands. These floods were generally dozens to thousands of cubic miles of water. The openness of this ecosystem lent itself to larger herbivores and in turn large predators, as well as because body size helps retain heat, due to the square cubed laws' effect on thermodynamics. This led to some of the most impressive megafauna of the time, and an open, fertile arena type landscape for them to meet on. There were many flowering plants, and the plants were more nutrient rich than those of most other biomes, even if the total biomass of the flora was generally lower.



PLAINS

6

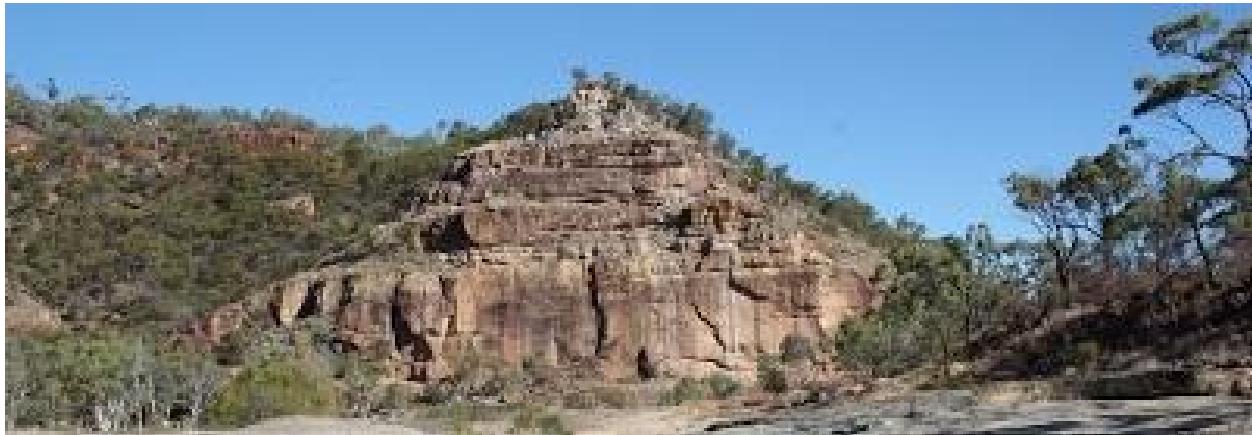
The plains are very similar to the great planes we know today, but farther south, and stretching further to the east than they are today. Tall grass could reach eight feet high, covered the ground and would change color with the seasons. It was not high in nutrition, so the herbivores had to compensate by eating more. This generally isn't a problem because grass grows extremely quickly, even in the drier conditions of the plains. Farther south the winters weren't as harsh or as long, allowing a longer growing season, but winters still came, and they were not easy. This is because you have to remove more snow to get the same nutrition when the food is less nutrient dense.

Part of what kept the grassland clear were the enormous herds of grazing animals which ate and trampled small trees which tried to form. Linear patterns work well in grass because it blends into the lines of the grass around you, and gets broken up further by shadows (cast by grass). The ease of motion over this terrain allowed for larger and faster animals to take hold, however the more sparse water supply posed population restraints. The open nature and hotter summers allowed for thin, fast builds which sought to outmaneuver or out endure their opposition, as well as space for the largest body types and herds of the era.



BUSH

A mix of large shrubs and tall grass, providing good cover both from and for predators, places to hide from the sun. This cover made ambushes much easier than chase, but also provided a no-mans-land for both forest and plains animals to interact. Slightly higher precipitation than the plains made it significantly more fertile, and fruits were more common than on the open grass. Also potentially kept open by large grazers, like mastodons and giant ground sloths which would have had the ability to shape their ecosystems around them, especially in large herds. Stealth was king for predators here, where endurance and outright straight line speed wasn't an option. Oftentimes the larger animals are most active at night in these ecosystems because they use the night as cover to hide from each other. This had the second most fruit of any fully terrestrial biome, but the 3rd most nutrient rich. The animals here were generally limited in size to what fit between the brush. Water was scarce, and parasites are common here, both flies and ticks though not the worst on the continent. This encouraged grooming, which encourages more complex social structure. Intelligence was significantly more important, and so was smell, because the brush gives limited visibility, and animals tend to make more sound moving through bush environments because they tend to be drier.



DECIDUOUS FORESTS

8

Requiring the second highest rainfall, deciduous forests were filled with lush, massive trees, reaching over 200 feet in height, and 10 feet in diameter at the base of the trunk. The massive limbs of the trees barred the land from titans of the open plains. The forest floor was just as busy as its canopy, providing shelter year round, as well as fruits and nuts for smaller animals in the summer months, offering low-hanging foliage, especially the nutrient-rich new growth of spring. The understory and ground cover provided shelter for both parasites (namely mosquitoes and flies) and predators, however the extreme abundance of food made it an extremely vibrant ecological niche. Here, camouflage and silence were the name of the game for chordata (vertebrates), however the abundance of food and water allowed amphibians and insects to use their R reproductive strategy to full effect, and they make a chorus day and night. The forests played host to the smallest, but largest variety of animals available at the time. The nuts from the trees provided a large source of food for smaller animals to store over winter. Some forests were seasonally flooded, in the floodplains during the spring, these forests would receive a healthy dousing of fresh silt to enrich their soil for the coming summer months, and oftentimes again in the fall. These floods nourished the forests, and helped to keep the rivers clear for the migratory fish. The soil was kept in place by the strong root systems, connected through a mycelium network which helps break down minerals the tree needs to generate wood in exchange for carbohydrates the trees make when photosynthesizing. The floor of forests is extremely alive, shifting with the movements of insects, and bound together through the growing filaments of a fungal network larger than any individual tree.



CONIFEROUS FORESTS

9

Coniferous forests had lower nutritional value, and were more acidic than deciduous forests. They were devoid of most megafauna during the warmer months, except for insects, small mammals and birds. They were a winter food reserve, staying greener than their deciduous counterparts even during droughts. A part of why coniferous forests are generally less ecologically diverse than deciduous is because pine trees make their own environment and sterilize their ecosystem to suit their needs. Pine tree branches help keep a bubble of humid, cool air around their trunks in the summer and block wind to maintain what little heat there is within the trunk. Their needles fall, and are so acidic they don't rot for months even under heavy rainfall. This kills ground cover plants, which coniferous forests don't need to retain water, because their needles form a spongy material while they decompose, which helps lock in rainwater. Because of this, they are almost desert-like (to me), in that they are often quiet, and you seldom see large life, similar to a desert or arid bush/grassland where nothing grows (except pine trees) and only pine nut eaters and the odd parasite can eak out a living in the high acidity and stillness of the pine forests. Because of the low fauna, there are fewer parasites than most other biomes.



WETLAND

10

Wetlands had an abundance of small game, in the form of mammals, amphibians, birds, reptiles, fish, and higher sodium/mineral content. Soft ground, too soft to support the largest of megafauna, except for the mat of hundreds of roots knotted together into a wooden carpet. Green life year round, be it above the snow or beneath it. In the summer and spring a great source of water, mud, and minerals for surrounding life. In the spring/fall invaluable locations for birds along their migrations. Oftentimes a meeting place for the titans of the land, where all are forced to commune. Those who live within the swamp find the highest abundance of parasites but also the highest ecological diversity on the continent. They are home to many keystone species, larval stages of all amphibians, many pollinators, and essential prey items for dragonflies and many more. Their dark rich mud is some of the most nutrient rich soil on earth, and the water plants have minerals which animals with tusks, claws and antlers need in order to maintain calcium and sodium levels, making them an essential piece of the ecosystem even for animals generally considered outside this ecosystem. The unstable soil and poor mobility through trees makes it generally too difficult for most extremely large megafauna to live here permanently. Strange carnivorous plants can be found in the peat moss bogs, and insects of exotic shapes and colors swim and fly through the air all year long. However, most animals here are summer visitors or seasonal, hibernating or leaving for the winter.



LAKES AND PONDS

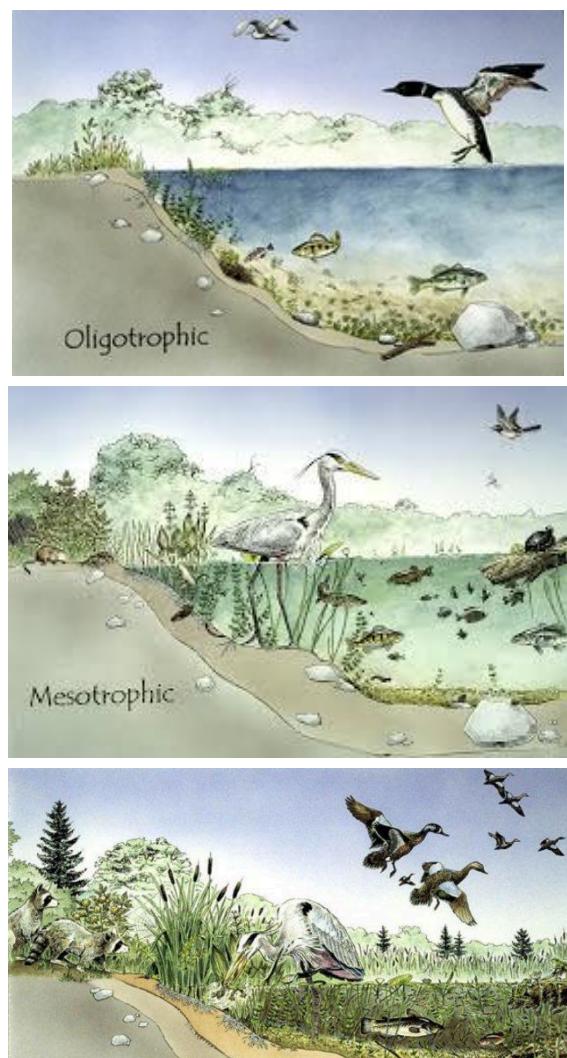
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Lakes come in a very wide variety of shapes and sizes, from small seas like Lake Baikal and Superior with a depth of 5,397 feet and a surface area of 31,700 square miles, to the smallest permanent bodies of standing water you've seen. Lakes can be divided into three major categories based on aquatic life, dissolved oxygen, and nutrient saturation.

Oligotrophic Lakes are the most sterile of the three types, containing the least amount of nutrients and organism in their waters. They are the coldest and deepest forms of lakes, filled with dissolved oxygen. They are home to strong swimming fish, though their populations are small due to lack of food. Oligotrophic lakes have rocky or sandy bottom, this lends itself to very few plants and insects. Oligotrophic lakes are fed by underground springs and melt water, making the water clearer and safer to drink than the other forms of lakes.

Mesotrophic Lakes contain the highest concentration of fish, as well as the widest variety. They are usually warmer and have less oxygen than oligotrophic lakes, but have a higher nutrient content in a balance allowing many more plants and insects to grow without allowing algae to make the lake go anaerobic. Mesotrophic lakes often are fed by rivers/streams and/or underground springs. They are the most common form of lake. Mesotrophic lakes usually have a shoreline populated by aquatic plants.

Eutrophic Lakes are more similar to marshes than lakes in some cases. They are warm and shallow, but are always lacking in oxygen. This is caused by a high level of nutrients in the water, causing huge algae blooms (which absorb oxygen and respire CO₂). Very few fish can tolerate such a low oxygen content, and those which can survive often have primitive lungs to make up for what the water lacks. Eutrophic lakes are often fed by runoff, and are almost never fed by underground springs.



RIVERS AND STREAMS

12

Much broader than the above biomes, rivers are always freshwater. Rivers and streams support a wide array of mammals, reptiles, fish, birds, amphibians and insects. They come in a wide variety of forms, from the goliath Amazon River which spans 30 miles across, over 330 feet deep, and 4,160 miles in length, to the small streams and rivers which are found throughout the world. These bodies of water can either be perennial, meaning they flow year round, or annual, meaning they are dry for part of every year. They can be fast flowing and frothy torrents, or nearly as placid as a lake, and anywhere in between.



Rivers almost always vary in the amount discharged based on the season. They cut away sediment and build islands, deltas and canyons. Because rivers are constantly in motion, they freeze long after still bodies of water are frozen over, providing a sanctuary for all amphibious air breathers.

For land based life, rivers are still an essential part of the ecosystem. Rivers offer water, with a much larger bank to provide more access points. They also harbor plants which contain a higher mineral content than those found above the surface, making them a highly valuable resource to all animals, and specifically the larger animals. Rivers also offer a seasonal treasure to carnivores, with their fish migrations. Once a year, coastal rivers are flooded with Salmon, and then again with Sturgeon. And throughout the year, these water bodies offer food to a variety of mammals, reptiles, birds, and amphibians



ESTUARIES AND DELTAS

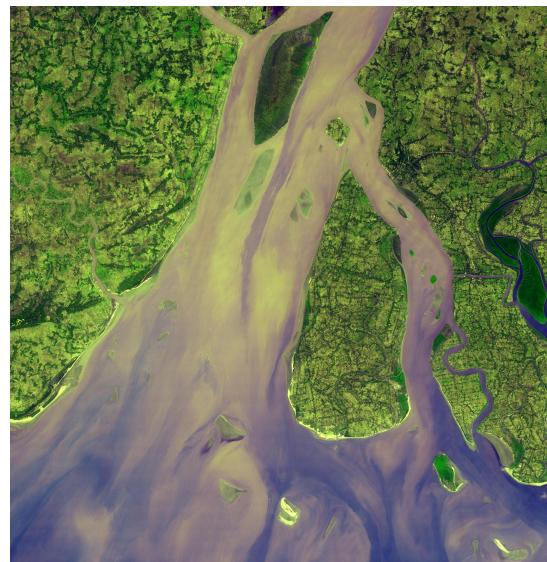
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(estuary left, delta right)

How they're alike: Estuaries and deltas are both where freshwater meets a larger, still body of (usually salt) water. They are influenced by both the flow of the river, and the tide. Because estuaries and deltas are constantly being refreshed with nutrients from both the ocean, and the river they are able to support more life than almost any other environment in the world. Estuaries and deltas are always slower moving than the rivers which feed them fresh water. Because they are fed by rivers they are slightly higher than the ocean, therefore decreasing the effect which tides have on their water level, though not negating the effects entirely. Estuaries and deltas are often used by marine fish as a nursery for their young, as they are food-rich, and relative to the open sea safer for small fish. They are also used by adults (semi freshwater fish) who lay eggs near the headwaters of the river.



How they're Different: Deltas are the mouths of rivers, where they separate and spread out over flatter coastal lands before flowing into the sea. Estuaries often appear more marine than deltas because they are deeper, wider and don't break apart into smaller channels. Estuaries are often formed in valleys of mountains, or between large hills, and are less prone to flooding than deltas.



HERBIVOROUS MEGAFauna

PROBOSCIDEA

ELEPHANTIDAE

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carnivora

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PROBOSCIDEA



ELEPHANTIDAE

MAMMUTHUS

18

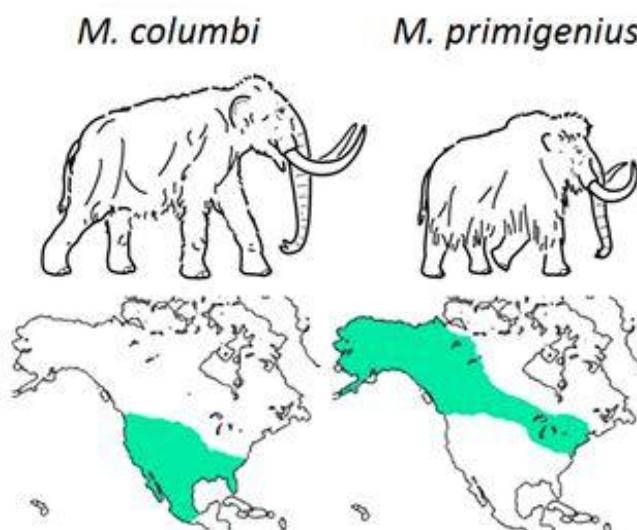
Mammoths were a keystone species of the North American pleistocene. They preferred grassland to forest and bush, due in part to their height, adults reached a minimum of 8.5 feet. However, their height would have enabled them to feed on low hanging tree branches and the tender tops of shrubs. *M. Columbi* was larger than *M. Primigenius* as well as modern elephants. Mammoths lived in matriarchal herds of females and immature males. Adult males would leave the herd once they reached maturity, leaving a herd to compete with each other for the ability to mate with females. These groups were lead both literally and metaphorically by an elderly female elephant, typically one who had birthed many of the herd.

Mammoths tusks were essential tools to them. They would be used to dig for buried tubers, uncover food buried in snow, and fighting both as defense against predators and to assert dominance among peers. Their tusks were angled lower and faster than those of modern elephants, increasing their downward reach while standing erect, but decreasing their eye protection while traveling through the thick shrubs or low-hanging branches of the forests. Mammoths used their trunks similarly to modern elephants, as a hand. Their trunks were able to delicately maneuver small objects, as well as toss logs, cats, and wolves.

Though these beasts reached monstrous sizes they generally traveled in herds, (again, like modern elephants) they were not entirely safe. The Columbian Mammoth

was hunted by the proboscidea-killer, *Homotherium* (pg 64). With their size, in conjunction with their tusks, the herd could form an impenetrable wall against predators, keeping their young safe behind them. This was a tactic many other herd animals employ to defend their young from predation.

Mammoths had much more robust fore quarters, and a larger hump on their shoulders, which gave them a much more sloped back than modern elephants.



M. COLUMBI

19

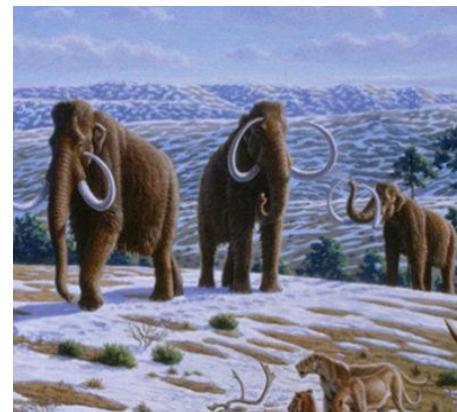
The Columbian Mammoth was the larger, lesser-known Mammoth of the southern states, and Mexico. It was 2 tons heavier than the Wooly Mammoth, at up to 27,600 pounds, with an average range of 15,000 to 20,000 pounds. This makes it larger than any land animal alive today. As its weight may suggest, it also grew taller than the Wooly mammoth, starting at 10 ft at the shoulder, and in large males could climb to nearly 14 feet. Columbi had the largest tusks, reaching 16 ft and over 200 pounds.



M. PRIMIGENIUS

The Wooly Mammoth was about the size of an African Elephant, and large males could reach 16,000 pounds in weight, and stand up to 12 feet tall. However, they were not all monsters, and were generally 8.5 to 11 feet tall, and weighed 12,000 to 16,000 pounds. Primigenius had tusks which were slightly smaller than its southern cousins, at 14 ft long and a touch under 200 pounds. Amazingly, the wooly mammoth only needed about 400 pounds of food per day to maintain a weight of 13,200 pounds, compared to the African Elephants 300 pound per day minimum to maintain the same weight in an environment generally 50 degrees warmer.

To achieve such thermal efficiency the Wooly Mammoths ears were much smaller than even the Asian Elephants, (to reduce heat loss through reduced surface area) and its coat of fur was thick (1/50 of an inch wide, to give perspective a human hair is 1/145 of an inch), long (the coarse outer layer reaching 15 inches), well oiled and multi-layered to be water-resistant, cold resistant, and an added layer of defense. If this wasn't enough, their skin could nearly reach an inch in thickness, with another four inches of fat to insulate even more. Their tails were much shorter than modern elephants. To compensate they grew long hairs on their tails which would have functioned as fly-swatter in-place of a flesh and blood tail.



Mammutidae

MAMMUT AMERICANUM

20

The American Mastodon was a forest dweller, leaner, shorter, and more muscular than Mammoths, but were still stockier than modern elephants. A small mastodon was



just 7 feet tall, a foot and a half shorter than the Wooly Mammoth, and at its maximum was 9.2 feet. They were longer in ratio to height than mammoths, and were 10 to 15 feet in length. Their bodies were more slender than Mammoths. Mastodon tusks curved upward more than mammoths, which would have provided more protection for their eyes as they

passed through the forests. Though they were significantly shorter and more slender than the Mammoths of the plains, they still reached 24,000 pounds as large bulls but could be as light as 8,000 pounds. Their tusks reached over 16 ft in length, and were significantly less curved than those of Mammoths, but still more so than modern day Elephants.

Americanum lived in bogs, marshes and coniferous forests (potentially rotating between coniferous forests in winter and fresh greenery from the wetlands in the spring, like Moose). This also may have been needed to make their destructive feeding habits equitable for their environment: switching between the two as needed to allow the conifers to rejuvenate all summer while they fed on the seasonal, lush marshes until they froze.

Americanum are thought to have a similar social structure to Elephants and Mammoths, with males leaving the female matriarchy of the herd to be solitary bulls the rest of their life. This is supported by the long maturation period, which would have required the aid of the herd to rear offspring.

To help Americanum cope with the cold, they grew a two-layered coat, aiding in heat retention during the winters, helping them survive the Alaskan winter during the LGM (latest/last glacial maximum).

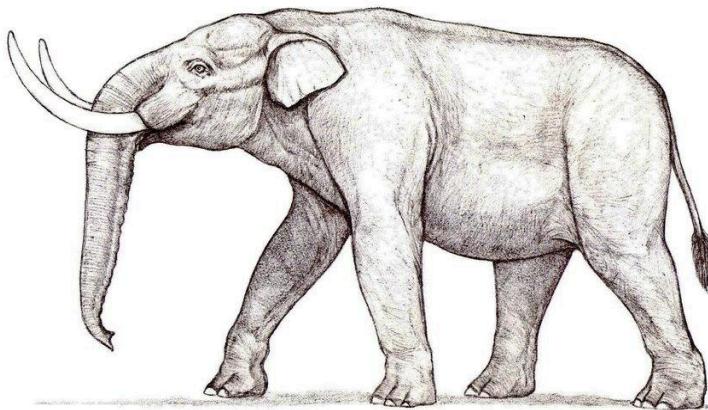


GOMPHOTHERIIDAE

STEGOMASTODON

21

Surprisingly, entirely unrelated to Mastodons. Stegomastodon are from a much more ancient family of Proboscidea, diverging from the modern lineage at least 15 million years ago, with this specific genus evolving 3 million years ago, and only going extinct 9,000 years ago (after most Mammoths and Mastodons). It was a warmer weather animal, preferring low altitudes and open grasslands, the latter probably to accommodate its mass, where their weak would often fall victim to *Homotherium* (pg 64). This animal reached 9 feet in height, 12 feet in length and weighed up to 13,200 pounds. Though 4,000 to 6,000 pound, and sub 9 foot animals were more common. Stegomastodon was much stockier than modern Proboscidea and mammoths.



Stegomastodon had tusks which could reach lengths of 11.5 feet. They were far less curved than both Mastodon and Mammoth tusks, not lending themselves to uncovering grass in the winter, but better for digging. Stegomastodon probably also used its tusks for defense against large bears and cats which it shared its range with.

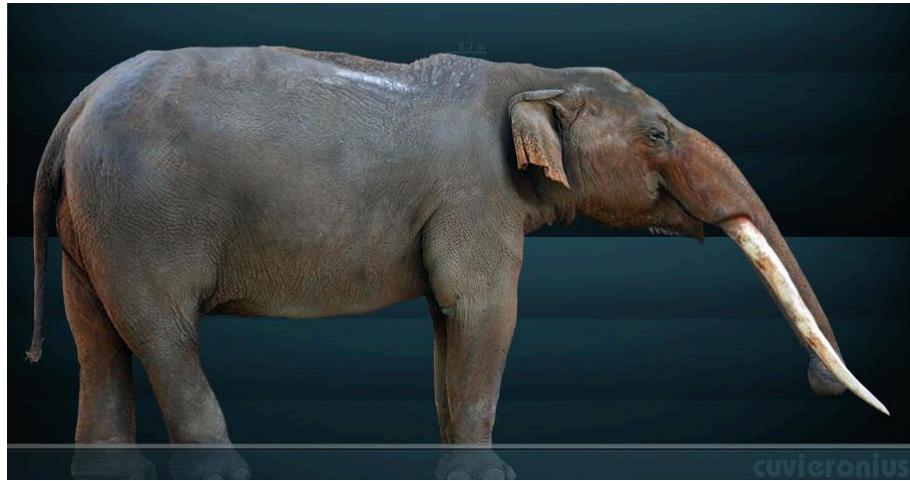
Stegomastodon was probably social, much like its distantly related cousins, the elephants. It had a similarly sized brain to the modern Bush elephant, but weighed significantly less, giving it a higher brain to body weight ratio (arguably more important than total brain size for intelligence). It would have made raising a child for many years a much more reasonable proposition, having other adults to help guard and care for the young, teach them how to eat, and how to defend themselves in such a fiercely competitive world.



cuvieronius

22

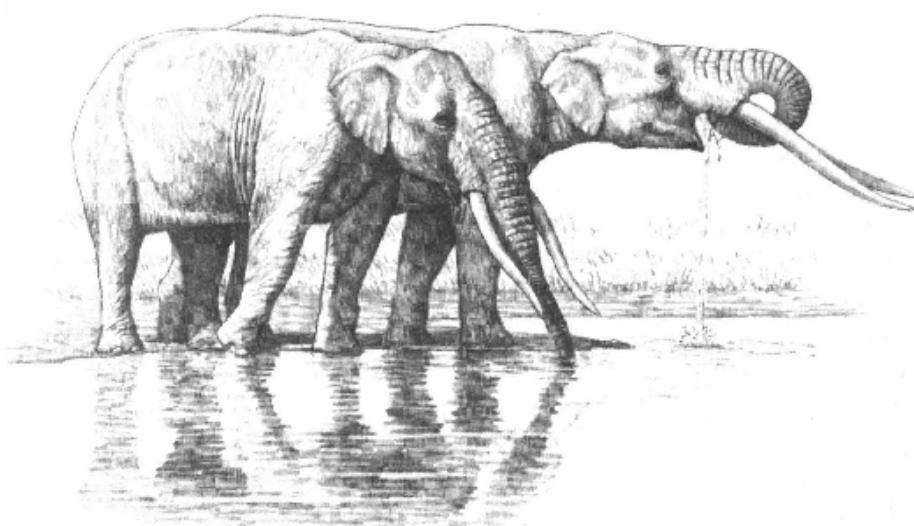
Cuvieronius was the smallest endemic member of the Proboscidea order found in North America, at “only” 9 feet in height, and 6,000 pounds. However, they had the longest time on the earth of the mammals on this list, starting 10 million years ago, and only going extinct 6,060 years ago (during the Ancient Egyptian Civilizations rise), existing for 10 million years. They are also a part of the old lineage of Stegomastodon, as opposed to those of Mammoth, or Mastodons.



cuvieronius

Cuvieronius was most common in the southern USA, and Mexico, and could be found nearly from coast to coast. When North America connected to South America, they were among the first to enter the strange new world of South America. Cuvieronius was primarily a forest dweller, and specifically highland forests, and even mountain dweller, where it was less likely to be in competition with Mastodons, as well as avoiding its cousin Stegomastodon (found in lowlands). More mountainous regions were also less inhabited by large predators (save for one), making them a more ideal place to raise young. Cuvieronius was also a social animal, in matriarchies for most of the year.

Cuvieronius's tusks were abnormally shaped, bowing out in the middle and being straight otherwise. It could reach 9 feet at the shoulder, and weigh up to 8,000 pounds in large individuals, only just smaller than Mastodons.



NOTOUNGULATA

MIXOTOXODON

23

Mixotoxodon was the second largest South American immigrant, at roughly the size of a white rhino, affording it protection against smaller predators. They weren't able to move very far north, only reaching southeastern Texas. However, they were very common throughout all of South America. They existed from nearly 2 million years ago and died out only 0.016 million years ago, along with the rest of their order. Their extinction is assumed to be due to the first American settlers, as they were found with arrows in their side.



mixotoxodon

Mixotoxodon weighed roughly 8,300 pounds, measured 9 feet in length and reached nearly 6 feet in height. It was of a similar build to rhinocerotidae, however it lacked the horn. Mixotoxodon was a very stocky animal, with a very robust and wide head. This gave it a strong jaw which they held very low to the ground, and also had an abnormal incisor, which grew its entire life, eventually forming somewhat of a tusk.

Mixotoxodon's low head made it likely that it was a grazer or grass eater, while its robust head (and specifically jaw) made it able to browse on woody plants and low to the ground shrubs. This made sense, as it preferred arid climates. This made Mixotoxodon a very versatile animal, if it was a particularly dry year and the grass wasn't growing, it would have been able to eat better than horse or bison



PILOSA

24

Giant ground sloths were the most successful megafauna introduced to North America, from South America during the Great American Exchange, and by the end of the ice age reached as far north as the Alaskan Yukon, and as far west as Georgia. Ground sloths occupied a variety of niches, but primarily revolved around being semi-amphibious. This advantages their size, and minimizes their losses to speed on land. Sloths were often social, forming multi generational herds like hippopotamuses and elephants, again leveraging their size to defend against large predators.

MEGATHERIIDAE

Eremotherium laurillardi

Eremotherium was one of the heaviest animals in its northern range, at 20 ft long, and up to 14,400 pounds though they usually weighed between 6,600 and 13,000 pounds. It stood 17 feet when on its hind legs, and with its arms would have been able to reach even higher. Eremotherium was restricted to the more southern part of eastern North



America, and as far north as South Carolina. This fossil spread implies that eremotherium swam through the west indies to reach florida, instead of hiking the arid deserts of what is now Mexico. Eremotherium likely lived like hippopotamuses, mostly aquatic. They were so hairless they couldn't survive outside of the water. This explains how they became so large and cumbersome, they had water to suspend their mass. They would have faced few if any predators when in the slow rivers and small lakes of the pleistocene save for small or injured sloths to Auctus (pg 80), only truly being in danger on land to the hypercarnivores like Homotherium (pg 64), Arctodus (pg 60) or dirus (pg 69).

Eremotherium was a relatively peaceful animal, and was not found to eat any meat (unlike its sister taxa, megatherium). However, it was more than capable of defending itself from any predatory attack, with its giant formidable, hugely muscled arms, two, one foot long, sharp, conical claws, made for bending tree branches, but also doubling as a lethal defense, if their thick hide, cartilaginous armor and sheer mass weren't enough of a deterrent.

MYLODONTIDAE

GLOSSOTHERIUM

25

Glossotherium was another giant ground sloth endemic to North America during the Pleistocene, its range reached just into the southern states. It evolved 2 million years ago and only went extinct 0.008. Glossotherium was not as bipedal, but was still able to stand semi-erect. To protect its claws from dulling, Glossotherium is thought to have walked on its knuckles like the much older and unrelated chalicotheres. Glossotherium reached lengths of 13 feet, and on rare occasions reached 3,750 pounds, though most weighed closer to 2,000 pounds. A unique feature of this animal was its ability to hear extremely low frequencies, potentially used to communicate long distances similarly to elephants in the african savanna today. Glossotherium also had an extremely large gut and low metabolism, helping it survive in nutrient and resource depleted areas, allowing them to live in bush and semi-arid environments where there is less competition. Letting them fill niches which were occupied by smaller more vulnerable animals. Their size offered protection, but they would have been vulnerable as adults to Arctodus (pg 60), Atrox (pg 65), Fatalis (pg 63), xenosmilus (pg 62)



PARAMYLODON

Paramylodon was much smaller than the aforementioned sloths, “only” reaching 2,400 pounds, and measuring just under 10 feet in length. However, it still had the powerful arms, and large claws to defend itself. In addition, Paramylodon had small osteoderms on its body, to provide an added layer of protection. It was very successful, being found from Guatemala to Alberta, and from California to Pennsylvania, and existing from 5 million, to 11,000 years ago. Paramylodon likely lived in wetlands and near shrubs, where the grazing is plentiful and the predators have trouble getting their footing.



NOTHROTHERIOPS

26

The smallest of the North American giant ground sloths, still weighing up to 550 pounds, and reached 9 feet in length. *Nothrotheriops* evolved 2.6 million years ago, and went extinct 0.011 million years ago. *Nothrotheriops* ate a significant amount of fruits, and as such played a role in seed dispersal, specifically of the *Yucca* trees which have lost range due poor germination since the sloth's extinction.



MEGALONYCHIDAE

MEGALONYX

Megalonyx was dwarfed at a mere 2,200 pounds and just 11 feet in length, by its cousin *Eremotherium*; however it dwarfed *Eremotherium* in range, found from coast to coast and north of the Alaskan Yukon. It was more of a forest animal, seeking shelter amongst the coniferous trees. Using the sloths slow metabolism and large body cavity to process plant material nothing else can. *Megalonyx* would have made for a relatively easy meal if a predator could sneak up on it. It possessed bulk, and was still formidable with its giant claws, strong arms, and good reach. *Megalonyx* was also somewhat social, and cared for young of different generations within the herd. This ensured the success of the next generation.



CINGULATE

GLYPTODON

27

Glyptotherium's closest relative is the armadillo, but it was closer in size to a Volkswagen Beetle, measuring 10 feet in length from nose to tail, and 4.25 feet in height. It weighed an immense 4,200 pounds. Glyptotherium, as you can see by the picture, is not built for speed; when the going got tough, it would pull its head in and wait out the threat. Glyptodon's armor measured 2.5 inches thick scutes, or osteoderms. Unlike its larger cousin, its tail was not spiked, but short and stout (though retaining the bony armor).



Glyptotherium was another successful immigrant during the Great American Exchange. It existed for nearly 4 million years, going extinct about 0.01 million years ago, and reached North America 2.5 million years ago. Glyptotherium's range included much of South America, nearly all of Central, and the southern states of North America by the end of the Pleistocene.

Glyptotherium was too wide to fit in forests and have any type of mobility, and so was restricted to more open lands. It preferred to stay near rivers, marshes and other bodies of water for the lush, and varied flora, lower amounts of apex predators, and mineral rich plants which grew in the waters it stayed near. It probably required much higher amounts of minerals to maintain its osteoderms than another animal of equivalent size/weight.



PAMPATHERIIDAE

HOLMESINA

28

Holmesina was a giant armadillo-like creature, though it was not directly related. Unlike its larger, also distant relatives of the Glyptodontidae, Holmesina had three bands in its armor which allowed it greater flexibility. It was also a newcomer from South America, and wasn't able to adapt to the cold climates. As such Holmesina was restricted to the south, found from Texas to Florida, being most common in Florida.



Holmesina was found from 2.6 million years ago, until 0.012 million years ago. Like Glyptodontidae, Holmesina was most at home near permanent freshwater supplies, though it was not restricted to them.

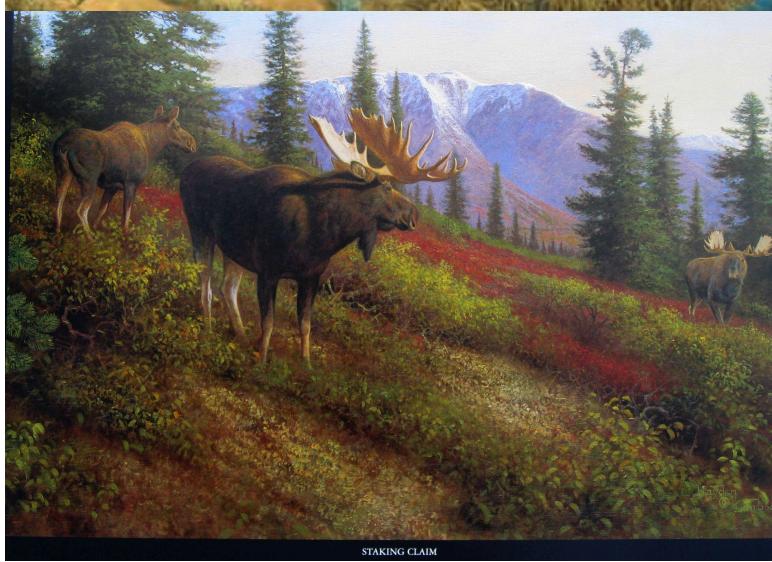
Holmesina was very large, reaching 600 pounds in weight, and measuring from head to tail, 8.5 feet in length. Holmesina was a very capable digger, much like modern armadillos, thanks to its robust front legs, and large, shovel-like claws.

This ability to dig enabled Holmesina to better access its food, ants (and specifically larvae), grubs, and other soft bodied insects. It is also thought to have been a grazer, probably preferring soft plants, and possibly even tubers to the fibrous grasses. Holmesina had very interesting teeth, they were entirely made of bone, without any enamel. As such, they wore down much faster than enameled teeth, to compensate, all of Holmesina's teeth grew its entire life.





ARTIODACTyla



TITANOTYLOPUS

30

The North American equivalent to a giraffe, a giant camel of course. Standing 10.7 feet at the shoulder, and possessing a 6 foot neck, it was able to reach nearly 19 feet. At this size, it weighed a whopping 5,000 pounds, it was the tallest animal on the savanna, standing 6 feet taller than even the mighty mammoth. It evolved this incredible height for the same reason as the giraffe, to browse on the canopy; a bounty unavailable to its shorter competition. The canopy has the newer growth, and would have provided much higher nutritional content, and been much easier to process in its gut.

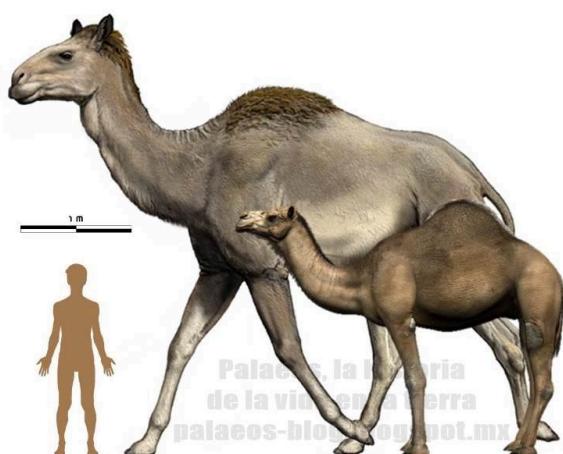


Titanotylopus, like modern camels, possessed a large hump on its back, as a method of food storage. Its size would have been natural protection, as would its ability to see from such a high vantage point. *Titanotylopus*'s long legs would have also made it very quick in a chase, and also made running much less difficult, as its gait would require fewer steps to achieve the same or greater speed. *Titanotylopus* height would have made it very impractical for it to walk through forests. However, in the winter months it would retreat to evergreen forests as a source of food through the winter months.

Titanotylopus was not a particularly social animal, mostly due to the fact that they were picky eaters and wouldn't find enough food to form groups of more than 20 individuals, save for possibly mating season.

To establish mating rights, *Titanotylopus* males had evolved robust and large canine teeth, which they would use to stab at each other, until a clear victor was decided, fatalities would not have been particularly uncommon.

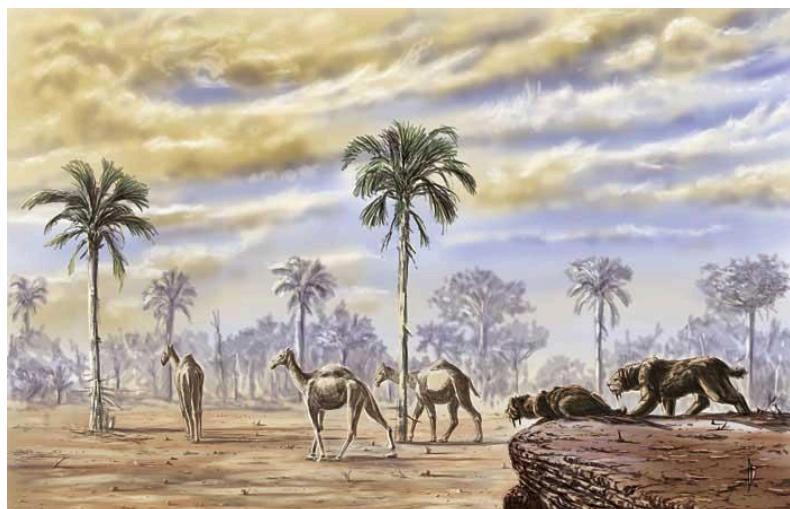
Titanotylopus began in the southern USA, and later spread into northern South America, and into Eurasia, its range ending in the Ukraine. It evolved from a heavier genus of camel 4.9 million years ago, and eventually went extinct 300,000 years ago.



The North American camel weighed more than even moose, reaching up to 2,600 pounds, though it usually weighed closer to 1,800 pounds, and stood up to 7 feet at the shoulder. With its head and neck it would have been able to reach significantly higher than other herbivores in its weight range such as bison. It was an opportunistic herbivore, meaning it would switch to whatever was most plentiful, be it grass, plants, or shrubs, and would have traveled between to different habitats depending on food availability.

They were most likely social animals, like their modern relatives which would have made them more difficult to hunt. Their groups would have been much smaller than those of Bison, and more like those of Latifrons, looser and significantly less than 100 individuals. On top of being so large, these camels would have been more adept at running than their modern cousins, due to their longer legs, also aiding in their quest to avoid predation in this hyper-competitive epoch. They were also nomadic, which means they would have crossed different predator's territories, making them harder to stalk down for predators unwilling to enter rivals turf. It is not known if they had evolved the hump(s) of modern camels, which would have potentially limited their water and energy reserves, when compared to modern camels.

Camelops was the last of the endemic North American camels, which had evolved here along with horses for dozens of millions of years, and went extinct 0.01 million years ago, at the end of the ice age, with most of the other North American big game.

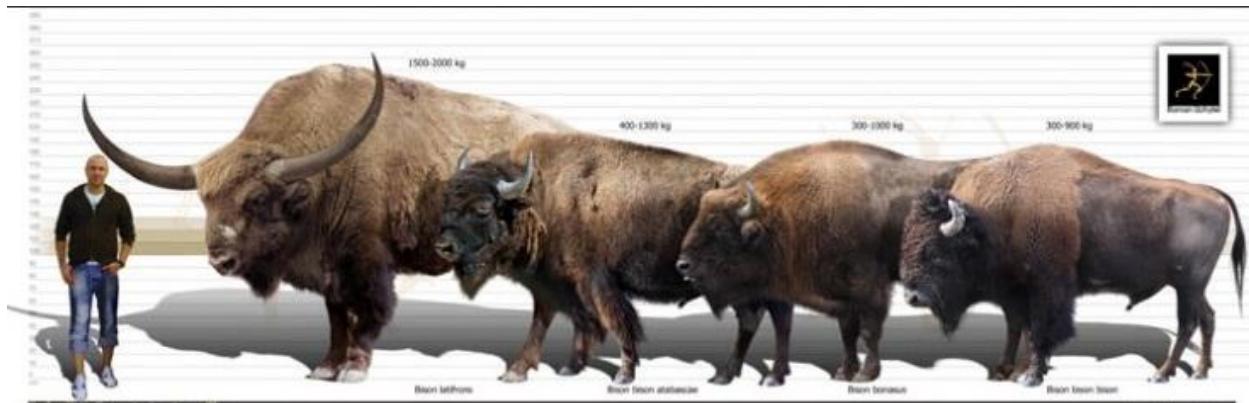


BOVIDAE

BISON

32

During the Pleistocene there were three species of Bison. *Bison Priscus* came to the Americas over the Bering Straights, as the cats, deer and mammoth did. At first there were two species, the *B. Priscus* and *B. Antiquus*. They were wildly successful on the plains and in the shrubs, but as time went on genetically different populations evolved. These populations with different niches formed larger herds and had smaller and less robust animals; while others grew much larger and became more solitary horns.



B. LATIFRONS

Bison Latifrons was the largest bovine to have ever lived. It grew to reach 4,400 pounds, and stood at up to 8.2 ft at the shoulder. It would have been incredibly imposing, with its horns, which could reach 7 ft from tip to tip, providing a deadly weapon to this behemoth. However, the span of these horns would have also restricted it to stay primarily in the open grasslands, opposed to the bush, forests, and marsh. It had a short time on this planet, going extinct 21,000 years ago, after beginning just 240,000 years ago. Like its smaller cousins, it too used its head to clear snow to eat the frozen plants and grasses beneath. It had a very powerful and sturdy neck, and was very well muscled. Due to its size it was probably significantly less agile than its smaller cousins, however it was much more formidable



B. ANTIQUUS

33

Antiquus grew to 7.5 ft at the shoulder and 3,500 lb and had smaller horns than Latifrons which it evolved from about 240,000 years ago and existed throughout the continent until about 9,000 ybp. It was the most common bison of the late Pleistocene, dominating the grasslands with its balance of strength, agility, and numbers. As the ecological pressures demanded more speed to escape predation, they grew smaller and eventually gave rise to Bison Bison, the existent species.



B. BISON

The modern American Bison has a maximum recorded weight of 2,800 pounds, however their usual weight range is between 700 and 2,200 pounds. They can reach over 6 feet at the shoulder, and grow to over 11 feet in length. Though their dimensions are massive, they are still able to leap a 6 foot obstacle. They are also able to run at up to 40 miles per hour, making them a difficult prey item to catch, especially for predators large enough to tackle them.



Bison travel in large herds over 10,000 during the pleistocene on the open plains, but in the forests as few as 20. These herds are generally ruled by one dominant, bull, who defends against predators and mates with the females exclusively. To maintain his alpha status he will butt heads with other bulls, and try to gore them. These battles can be very dangerous and may sometimes result in death for the loser and the victor.

B. PRISCUS

B. Priscus, or the Steppe Bison was endemic to North America, Europe, Asia, and Beringia during the ice age, are the ancestors to many of the bison we have today, from the European Bison, to the American Bison, and even the mighty Latifrons. It began in Eurasia, 2 million years ago, and spread throughout the Holarctic. It was the smallest of the trio, reaching a maximum weight just shy of 1 ton (1,900 pounds to be exact).

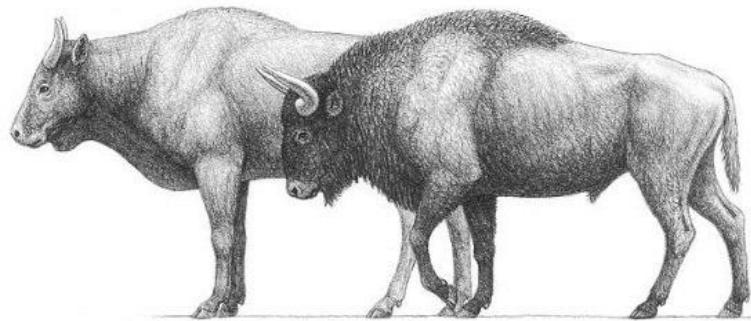


CAPRINAE

EUCERATHERIUM

34

Euceratherium was a large oxen, closely related to the modern Musk Ox. It was the first bovine to arrive in North America, reaching the continent about 2 million years ago. It went extinct just 0.0115 million years ago. Euceratherium had a large range, spanning from Beringia, south to northern Mexico, and east to Illinois. Its preferred habitat was the edge of forests, in deciduous forests and in the surrounding shrubs and bushes. Euceratherium was most commonly found in hilly areas, as opposed to flat lands.



Euceratherium grew to 1,330 pounds, placing it in between Bison and muskoxen. It would have been more nimble than the Bison, but also less formidable due to its smaller size.

BOOTHERIUM

The third genus of Bivone native to the North American Pleistocene. It evolved about 2 million years ago and went extinct just 0.011 million years ago.

Bootherium was likely also a woodland animal, though it frequented prairies. In the winter it would go into the coniferous forests to feed on the evergreens. Bootherium was found from the Yukon valley south to California, and east to New Jersey. It was not much heavier than the existent musk oxen of the tundra, at 940 pounds; but leaner, taller, and (most likely) faster.



More commonly referred to as the Muskox, it is the smallest bovine in this document, at *just* 900 pounds. Bulls grow to over 8 feet in length, and cows can stop growing at just 5 feet in length, and both bulls and cows range from 4-5 feet in height. Muskoxen are very well adapted to the cold, having extremely long, coarse outer coat, and very fine, dense undercoat. Muskoxen also have very short tails seldom reaching 4 inches in length. Though highly functional cold insulants, the muskoxen also possessed another adaptation to handle the cold, natural antifreeze in their blood. During the ice age, they were not limited to the arctic circle, spreading from Eurasia then Beringia, grazing as far south as the edge of the Tundra, in the lower 48 states. They evolved more recently, as a reaction to the extremes of the ice age, and only arrived in North America a few hundred thousand years ago.

During the rut, muskox live in herds of cows led by one bull. The bulls would compete for access to mates by butting heads in July, and by the end of the month the "season" is nearly over. After this, gestation begins and females take control of the group by deciding where to go and when to sleep. Calves were raised by their mothers, but their first line of protection is their father (in most cases). In the summer, muskoxen gravitate to the more fertile lowlands, to stock up for the winter, and for the ease of living. But in the winter, muskoxen travel into the highlands to escape the deepest snow.



CERVIDAE

A. ALCES

36

Better known as the modern moose, *Alces* was relatively new to the North American Pleistocene, having migrated from eurasia, it filled a niche already occupied by another giant swamp-deer; time would prove *Alces* the victor. Moose are very large, and can weigh anywhere from 600 to 1,800 pounds, and reach 7 ft at the shoulder. Moose have a very muscular body and long, thin legs, allowing their gait to cover greater distances in fewer strides with less weight to move. Their long legs also helped them reach their top speed of 35 mph.

Moose prefer to eat the new-growth of maple, aspen and birch of wetlands. To help make up for their lack in salt, they feed on aquatic plants in shallow wetlands. When winter comes, they move into the evergreen forests, where their 7 ft height comes in very handy, giving them access to things which not even bison can reach.

Outside of the breeding season, Moose are solitary. Females and males will share an area at times, but not for the sake of company. The bulls will challenge each other during the breeding season (as all deer do).



C. SCOTTI

Also known as the Stag Moose, was not quite native to North America, though it had lived here for longer and is nearly identical to a moose size and especially in the niche it tried to fill. It lived in forests, swamps and evergreens, and weighed up to 1,600 pounds. Scotti could reach 8.2 feet at the crown of its head. It would have had a similar top speed to its cousin, *Alces*. Scotti is a part of an extinct group of giant deer which were found across the vast majority of the holarctic. It died out 11,000 years ago, and is thought to have been outcompeted by *A. Alces*.



cervinae

C. canadensis

37

More commonly known as the Elk in North America (referred to as the wapiti throughout Eurasia), was a common sight throughout North America's various habitats during the Pleistocene, rivaling B. Bison in numbers. Elk are social animals, staying in gendered herds during most of the year, and harems during rut (mid-late fall). They were a common prey item, and therefore used their numbers to be that much more vigilant as a defense.

Elk were the third largest species of deer alive in North America during the Pleistocene, the largest bulls weighing in at over 1,300 pounds. However, bulls more commonly weigh between 660 and 1,200 pounds, and measure 5 feet at the shoulder. Female Elk, or cows measure 4.5 feet at the shoulder, and weigh between 500 and 630 pounds. Their length was between 7 and 8 feet. They were a very lean animal, and had much smaller hooves than Moose, which aided them in reaching 45 mph while running; but it also made traveling over soft ground more difficult, as their feet sink in quickly, forcing them to keep away from marshes.

Elk were most commonly found on the plains, but were not uncommon in the bush, or even the forest, as they were small enough to easily fit between the trees, and strong enough to push through small briars. Because grass is low in nutrition, Elk had to eat for the vast majority of their waking hours, consuming up to 16 pounds per day.

Elk were a common prey animal, as they were one of the smaller open-land animals. As a defense they joined in herds of up to 50 individuals, making singling out an individual much more difficult, as well as having 50 pairs of eyes, ears, and nostrils to detect potential predators.



Closely related to Peccaries, though much larger. *Platygonus* evolved some 5 million years ago, and went extinct 11,000 years ago. During this time it was found throughout the Americas, reaching the southern boundary of the ice sheets in Michigan and Canada, spanning to the west coast, and south into Mexico. They were found in brush around the plains and in thin forests. To help defend against predators, they lived in herds which had semi-permanent bases of operation, typically a cave was used, but other semi-permanent structures were used as well.

Platygonus differed from peccaries in diet, as well. They ate nearly exclusively plant, to help them digest this fibrous diet, they developed a multi-chambered stomach, allowing for more food to be more efficiently consumed, to aid in extracting every ounce of nutrition the various grasses and woody plants were low in. They had much shorter tusks than modern peccaries and pigs, making them useless as tools for digging, and instead made them better at defending against predators. *Platygonus* had longer legs and grew much larger than modern peccaries, standing over 2 and 1/2 feet tall in many cases, and growing over 3 feet in length. Though this isn't enormous in dimension, its bulky body made it heavier than one might expect, at 150-250 pounds in adults, with abnormal individuals reaching 360 lb.



PERISSODACTyla

EQUUS

39

Equus in North America were very similar to zebras in Africa being social plains animals and primarily feeding on grasses. They were herd animals, and that is where they drew their strength. Being unarmored, and unable to defend themselves, numbers and speed were their greatest assets in evading the plethora of hypercarnivores more fierce than the lions, tigers, and bears of today. They were open land animals and wouldn't have been able to hide from predators, besides blending their silhouettes together like zebras. Common predators of all species include *P. Atrox* (pg 65), *P. Onca* (pg 65), *C. Dirus* (pg 69).

EQUUS GIGANTEUS

The largest equus of all time (excluding draft horses), weighing in at 2,600-3,300 pounds, and measuring 7.5 feet at the shoulder. *Giganteus* has been found with woody plants in its digestive system, to aid in this its jaws were exceptionally strong and robust. *Giganteus* would not have traveled in large herds like smaller more vulnerable equids, as it could deliver a swift, very powerful kick, and even bite with enough force to crush a paw. *Giganteus* had a large range, found from California to NY and FL, with most of the population in the plains.

EQUUS OCCIDENTALIS

A large horse of the North American Pleistocene, and is also known as the Western Horse; weighing up to 1,150 pounds, but shaped more like a zebra, round and short. Its range included southern California to west of Texas, south of, and no farther south than the Rio Grande River where they likely faced the terror bird (pg 112). It existed from 2.5 million years ago until just 0.01 million years ago.

EQUUS SIMPLICIDENS

Also known as the Hagerman Horse, it is the first species of equus, and therefore the forbearer of all equus; having evolved 3 million years ago, and finally going extinct at the end of the ice age, 0.012 million years ago. It was found from Texas to Nebraska to Florida. It weighed between 385 and 847 pounds, and stood between 3.5 and 4.5 feet at the shoulder. They also likely became

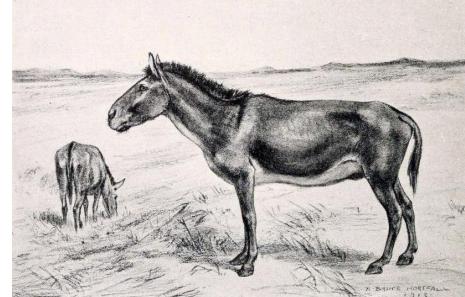


the meals of large crocodilians such as *A. Mississippensis* (pg 81) when they drank from large bodies of water

EQUUS SCOTTI

41

They were about the same weight, from 400 to 700 pounds in weight. They were shorter than modern horses, at roughly 4 feet at the shoulder and had a rounder body than modern horses, again similar to zebras and steppe horses. Scotti was found from Texas to Chile, and existed from 4.9 to 0.009 million years ago.



EQUUS LAMBEI

Also known as the Yukon Horse, its range was from Siberia to Wisconsin, and west as far as the coast. It is thought to have stood around 4 feet in height, and probably weighed around 500 pounds. Lambei is thought to have been a bush-dweller, avoiding the open plains in favor of shrubs and bush based diet, as opposed to grass. This equus evolved about 2 million years ago in Beringia, and went extinct 0.01 million years ago.



EQUUS CONVERSIDENS

Conversidens was found in the southern 1/8 of California, the southernmost of the Rio Grande River basin, and just east of Texas. It was a small horse, probably weighing less than 500 pounds.

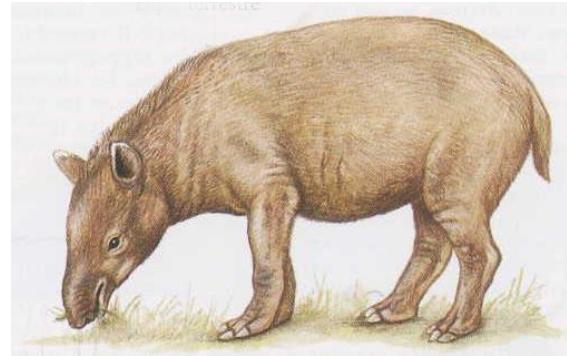
HARRINGTONIPPUS FRANCISCIS

Franciscis was found from Texas to Florida, and north to Alberta, Canada. Its lineage diverged from *Equus* just under or roughly at 5 million years before present, developed 3 million years ago and went extinct 0.012 million years ago. They weighed up to 770 pounds.

TAPIRUS

42

Tapirs were common throughout North America, and could be found from California, to Florida, to Pennsylvania. It would have been a bush and deciduous forest animal, having been too small to defend itself against the enormous plains predators, and too slow to run from smaller, nimble pack hunters. Tapirs were generalists, feeding on vegetation, aquatic plants, fruits and seeds. They were solitary animals, preferring to stay hidden as their main defense against predators.



T. MERRIAMI

The largest of the American Tapirs, its range stretched from California to Arizona. No estimates are known for weight or length of this animal, but it would have probably weighed around 1,000 pounds, and 8 feet in length in the largest individuals. Their range was from California through Arizona, preferring inland shrubs.



T. COPIE

T. Copei had a large range from the Everglades to Pennsylvania and west to California. It grows to 900 pounds, 4 feet at the shoulder, and 7 feet in length. It was likely a subspecies of the other tapir species found throughout North America.

T. CALIFORNICUS

The smallest and most wide-spread of the American Tapirs. It weighed up to 500 pounds, and could reach 4.6 feet in length. It would have been about the same weight, maybe slightly heavier than the White Tail Deer.



carnivora

ursidae

ursus

43

The ursus genus was a prolific fixture during the ice age, throughout all biomes. These large omnivorous beasts were less predators than we think of today, and far less “apex” than they are today. On the savanna, and in the forests they were strong enough to hold their own against most predators, and as a result seldom fell prey to hypercarnivores, even as a solitary creature. They would have been dangerous game, but not entirely free from predation. Bears rarely ate meat, it made up just 15-30% of their diet and of that most was found carcasses, not hunted kills. Ursus were more of a herbivore/insectivore/pescetarian/scavenger, or to put it simply, omnivore. Bears have a very wide weight range depending on food availability (much wider than most other animals).

Bears used their incredibly strong, flexible upper bodies and large claws to dig up tubers, flip boulders, or tear into logs to get at the insects unavailable to other herbivores and insectivores. To aid in its ability to retrieve food from the ground, arctos also have a developed and sensitive sense of smell, to detect food buried or locked inside a log. These essential tools also double as a deadly weapon, and are known to be capable of decapitating moose in a single strike, and even killing a fully grown bison with one blow.

Bears ability to stand on their hind legs allowed them to reach fruits, and stand while fighting, freeing their front legs. It also enabled them to get a bird’s eye view, to see predators coming, and catch the scent of food, and predators obscured from view



U. ARCTOS

44

Brown bears can reach weights of up to 1,400 pounds frequently along the coast, inland their weight drops as low as 400 pounds putting them just above the big-cats in weight. However, Arctos stands at *just* five feet at the shoulder on all fours, and can reach 10 ft on its hind legs. The hump on Arctos back is made of muscle, much more pronounced than any other bear. This, and its very thick and muscular arms make Arctos far stronger than a feline of a similar size, let alone the size advantage. Having such strength and long legs, this bear is able to propel itself at 30mph for short distances.



If the claws weren't enough, the bears jaws are capable of applying 1,200 psi. Its immense strength and dangerous claws would have made it a very dangerous animal to attempt to hunt, with its acute sense of smell and good ears it would have been equally hard to sneak up on, which is why they are comfortable in open areas.

U. AMERICANUS

The American Black Bear, surprisingly not much smaller than its big sister, the Brown Bear. Americanus reached a maximum weight of 1,100 pounds. However, they usually weigh between 125 and 600 pounds in males, and 90 to 375 in females. Black bears can reach up to 4 feet at the shoulder in large males, but typically range from 2.2 ft to 3.5 feet on all fours, and when reared up can top 7 feet.

Black Bears are considerably less muscular than Grizzlies, as evidenced by the lack of a muscular hump above their shoulder blades; however they are still much stronger than most other members of their order (carnivora). Black bears were aware of this fact, retreated to forests and their fringes, safe from the largest predators of the open lands and Grizzlies. Black bears have much sharper, shorter claws than grizzlies, allowing them to grasp trees in order to climb them to escape Atrox (pg 6x), Fatalis(6x), Simus(6x) amongst others. Although Black Bears legs are shorter than those of grizzlies, their lighter build enables them to reach speeds of 35 miles per hour.



TREMARCTOS FLORIDANUS

45

Floridanus filled the same ecological niche as the grizzly bear, an omnivore with no specific habitat. It evolved roughly 3 million years ago, and went extinct 0.008 million years ago. It was endemic throughout North American's southern half, from the east coast of Tennessee, southward to Florida, and west to California's coast.



Floridanus was of a very similar size to the eurasian invaders, brown bears of the North West. Male bears weighed approximately 660 pounds and upwards, while females weighed about half of that (330 pounds). They had large blunt claws, and an upper body which was more robust than a black bear, while still lacking the large hump of muscle on their shoulders. However, unlike the competing *Ursus* genus, Floridanus's jaws were slightly shorter and wider, more like its larger cousin. Similar to its competition, Floridanus's diet was upwards of 80% plant and insect. Unlike its cousin its dentition was better adapted for an omnivorous lifestyle, specifically with regards to its molars, which were flatter.



RODENTIA

AMBLYRHIZA

46

Amblyrhiza looked very similar to a Capybara, this giant rodent roamed the West Indies. They were a land based animal, not nearly as amphibious as their cousins the Capybara. Instead, Amblyrhiza preferred to roam grassy, rolling hills in the Caribbean Islands which offered an ample food source year round. Adults weighed just 110 pounds, but grew to a weight of 440 in the largest individuals. Amblyrhiza died out around 0.011 thousand years ago.



NEOCHOERUS

Neochoerus is, more or less, a giant North American Capybara. They weren't able to reach far north into the continent, following the Gulf Coast to South Carolina, eventually spreading west to California. It lived a semi-aquatic lifestyle, and looked remarkably similar though it may not be in the same family as the existent capybara. Neochoerus Differed from the modern Capybara in size, averaging 40% heavier, or up to 250 pounds, and 6 feet in length. They lived in and along rivers, lakes, and wetlands as its preferred food was aquatic plants. Also, not being particularly fast on land, the water offered refuge from the surfeit of predators.



CASTOROIDES

47

Castoroides was a giant beaver, found from Florida along the east coast up to the Hudson River, and east with the highest concentration being found in the great lakes watershed. Their range also spanned into Canada, and north into Alaska. They first evolved 2 million years ago, and were one of the first species to disappear after the last glacial maximum (about 24 thousand years ago).

Giant beavers are believed to have lived exclusively in lakes and ponds bordering marshland, which they likely harvested saplings from as well as food. Marshland also probably acted as shelter from storms and predators. That Castoroides couldn't "create" its own marshland most likely incapable of adapting to rapid changes in its environment.

The Giant Beaver physically would have appeared half beaver, half muskrat. They had a smaller brain, likely incapable of building dams. However Castoroides did build massive lodges 1.2m tall, 2.4m in diameter out of saplings no wider than 3 inches. Their wider, more chizzle-like 6 inch long incisors were poorly designed for chewing through large trees, leading experts to believe it didn't construct a dam. Its feet were powerful and webbed which it used to make up for its less developed tale, and likely aided it in traversing marshland efficiently. It weighed between 180 and 250 pounds. Its body measured 6 feet in length.



Part Three:

48

Sirenia

DUGONGIDAE

HYDRODAMALUS GIGAS

45

TRICHECHIDAE

TRICHECHUS MANATUS

46

DUGONGIDAE

HYDRODAMALIS GIGAS

49

Also known as the Steller's sea cow, is the largest of the manatee/dugong order. They evolved as a similar form 3.6 million years ago, and only went extinct in the early 1800's. During the pleistocene Hydrodamalis had a range which spanned from southern California, north to the north sea, then back down southeast to the Hokkaido island. Hydrodamalis lived in shallow rocky kelp forests, offering natural protection. They used their large limbs to protect their young, which they raised likely until some point in puberty. In addition to their young, Hydrodamalis also formed monogamous pairs within multi-generational family groups and would protect each other, forming strong family bonds. As hydrodamalis fed on the kelp, they would avoid the more fibrous parts and in doing so cause the stalks and roots to wash ashore in large clumps, offering more shelter for turtle nests, crabs and any other small animals in the environment.



Hydrodamalis reached up to 20,000 lb and 30 ft long, but usually weighed between 10,000 and 16,000 pounds and about 20 ft. Not only was this an effective defense against everything except orcas, great whites and megalodon but it also gave them a lower surface area/mass which helped keep them warmer. In addition to their size, to survive storms in the shallows they developed thick skin of roughly an inch, and another 3-4 inches of blubber to insulate and cushion. Unlike pinnipeds, sirenians are entirely herbivorous. This means their food source is significantly less nutrient and energy dense, forcing them to eat a lot more and to have a larger intestinal tract to properly extract nutrition from their food. Their stomachs could be 6 feet long, and intestinal track up to 500 ft long, more than 20 times the animal's length. Their intestinal tract most resembled modern ungulates such as deer and horse, though they diverged 59 million years ago.



TRICHECHIDAE

TRICHECHUS MANATUS

50

Also known as the West Indies Manatee, can be found in the shallow coastal areas from DC to the Amazon river. They feed on seagrass and other sea and freshwater plants which have a low nutritional value. Unlike their larger cousins, they are too small to properly insulation from the cold due to mass alone, so they require water temperatures of at least 68 degrees. Their low cold tolerance is also caused by their low metabolism, which does aid them in diving, enabling them to dive for longer. In spite of this slow metabolism ,they still consume up to 10% of their body weight in a day. The manatee's low cold tolerance forces them to move from deeper waters in the summer to shallows in the colder months. Because their environment is so well protected from predators, being too shallow for large sharks and whales, and too open and saline for most crocodilians they seldom run into natural predators.



Manatees measure between 8.5 and 12 ft, and weigh between 440 and 1400 lb, though the largest reach 15 ft and 3650lb. At this size, they are too large for even the largest land based predators to attempt to dive into the shallows. Manatee's also have a similarly simple, but extremely large intestinal tract for making the most out of their food. Though they are very large, they reach sexual maturity very quickly, males as early as 3 and females as late as 5. Females can give birth every 2-3 years and continue to give birth into their 30's.

Manatee's have poor eyesight, to compensate, they have vibrissae; which are essentially whiskers that cover their body, giving them directional pressure sensing. These whiskers have the same mechanisms that give big cats the ability to find the jugular



PART FOUR:

51

PINNIPED

PHOCIDAE

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PHOCIDAE

MIROUNGA ANGUSTIROSTRIS

52

Pinnipeds are known as seals, seals evolved from carnivorans, their closest non-seal relative is the bear, closer than even sirenians whose appearance is merely convergent with seals, instead of actually being sister taxa. This is called convergent



evolution. This is the largest seal species in North America, the Northern Elephant Seal. Giant pescatarians, their fatty, protein rich diet allows them to swim with more energy than Sirenians. *Angustirostris* shows extreme sexual dimorphism, with males being 3-4 times the weight of the females. This is due to bulls violently fighting, sometimes to the death for large harems of females. The

bulls rear up and slam into each other, using their tusk-like canines which reach up to 4 inches in length. Their dentition is clearly that of a carnivore, they have strong jaws with robust, conical canines like bears, cats and other carnivorans.

Angustirostris are very adept divers, regularly diving to 100-200 feet to hunt; and capable of reaching deeper than most whales at 5,800 ft and holding their breath for up to an hour, because of this their diet is not very well understood. *Angustirostris* is also a very capable swimmer, traveling up to 60 miles in a day to reach their preferred fishing. Their diet includes small sharks, rays, squid, and just about anything else between about 10 and 150 lb that moves, and they have the ability to catch. In addition, to sense prey in the reduced light they use their vibrissae though they are confined to the area around the mouth and not their entire coat like their convergent brethren.

Angustirostris is nearly an apex predator in its environment. As adults bulls reach up to 8,200 lb and 20 feet in length, and their thick skin and powerful jaws offer protection. However, females can weigh as little as 880 lb as an adult, though they can weigh as much as 1,980 lb, still a fraction of the largest bulls at 8,200 lb, but closer to the smallest bulls are just 3,300 lb.



NEOMONACHUS TROPICALIS

53

Tropicalis, once known as the caribbean monk seal, is an extinct seal species from the west indies, and coastal waters of the gulf. They were very intelligent hunters, and agile swimmers. They evolved between 4 and 11 million years ago, and went extinct due to gunpowder hunting in 1951. Catching fish in the sun, trying to escape hunters like sharks, humans, crocodilians and the terrestrial predators along the shore, tropicalis had a very dangerous life.

Tropicalis gathered in groups to sun, likely as a defense against predators who can only attack one seal at a time, and also making each individual more defensible. They were not deep divers compared to their cousins at just 1,500 feet, however their environment didn't get much deeper than this, preferring to fish the channels closer to the super-productive reef ecosystems and the prey that radiated from them. These intermediate waters between the open oceans of the atlantic which are petroled by sharks and the mangrove coasts, which crocodilians rule, provided an extremely fertile ecosystem with little competition at their ecological strata, similar to their elephantine cousins.

Tropicalis grew to between 6 and 8 feet in length. Their long, cylindrical body allowed them to be agile enough to chase scholes of fish which many other predators didn't have the ability to pursue. They weighed between 375 and 600 pounds, making them too large to be attacked by all but the largest shark species, as well as their bear-like jaws offering some reprisal for woodbee attackers. In addition, their fur also grew algae on it, which likely helped mask their scent from predators and changed their color to something that matched the ocean more so than brown or tan.



PHOCINAE

ERIGNATHUS BARBATUS

54

Also known as the bearded seal, is a species of seal found around the ice shelves of the pacific and atlantic coasts and throughout the north and arctic seas. They prefer shallower waters, to avoid the cetaceans. Because of this shared range and habitat, they are a favorite prey item of ursus maritimus. Though barbatus prefers shallow water they can still dive to depths of up to 1,500 feet. As adults they stay shallow and eat a more varied diet, with heartier prey, as young they'll dive deeper to reach softer, less defended prey such as sea cucumbers and polychaete worms. Barbatus grows to between 6 ft to 9 ft and weighs between 400-950 pounds.



CYSTOPHORA CRISTATA

The hooded seal, named for the sac in its nose which the male inflates to send sound through the water more effectively than regular vocalizations. This is also likely a trait selectively chosen for by females, which likely doesn't offer enough of an environmental benefit to evolve on its own. Cristata is sexually dimorphic, with males being about 30% heavier than females. The species ranges in size from 320-900 pounds and reaches 6 to 8.5 feet in length. Cristata's range is primarily around Greenland and the Arctic Archipelago



Though it is not taxonomically dubious, I see more similarities with elephant seals both in morphology and in behavior. They are deep divers like elephant seals, capable of diving to 3,300 ft

ODOBENIDAE

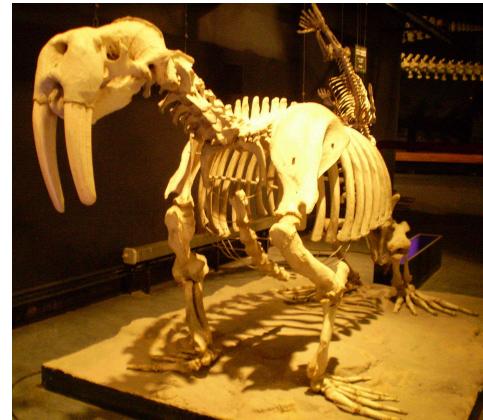
ODOBENUS ROSMARUS

55

Also known as the Walrus, *Odobenus* is the sole surviving lineage of a once thriving family of pinnipeds who ruled the ocean in forms similar to seals and sea lions until about 5 million years ago. *Odobenus* is not an active predator, preferring to drag their snout along the ground in search of sea cucumbers, soft corals as well as anything else fleshy and slow. Though they eat from the sea floor, they aren't the divers that most other pinnipeds are, only reaching 1,600 feet.

Odobenus is a social animal with a basic social structure, they are not monogamous, the bulls bellow for dominance, rarely using their tusks to fight, because they are too deadly. They have a similar structure to bison: herds with a loose if any hierarchy. They mainly group for safety in numbers. They migrate from their fishing grounds to their breeding grounds, sometimes crossing hundreds or thousands of miles.

Rosmarus uses its famous tusks which can reach 3.3ft in length and weigh up to 12 pounds. They use these tusks to maintain their angle while they shuffle along the bottom. These tusks can be used as weapons by the bulls and can also be used as tools to grip the ice and pull themselves ashore. The beasts themselves generally weigh between 1,200 and 3,000 pounds, though the largest bulls could weigh 5,000 pounds. In addition to their size, their skin can also reach up to 4 inches thick, blocking almost all attacks. At these sizes, and in the shallower water, they were able to avoid the largest cetaceans, and certainly too well defended to be killed by terrestrial predators, allowing them to peacefully graze on simple eukaryotes on the seafloor.



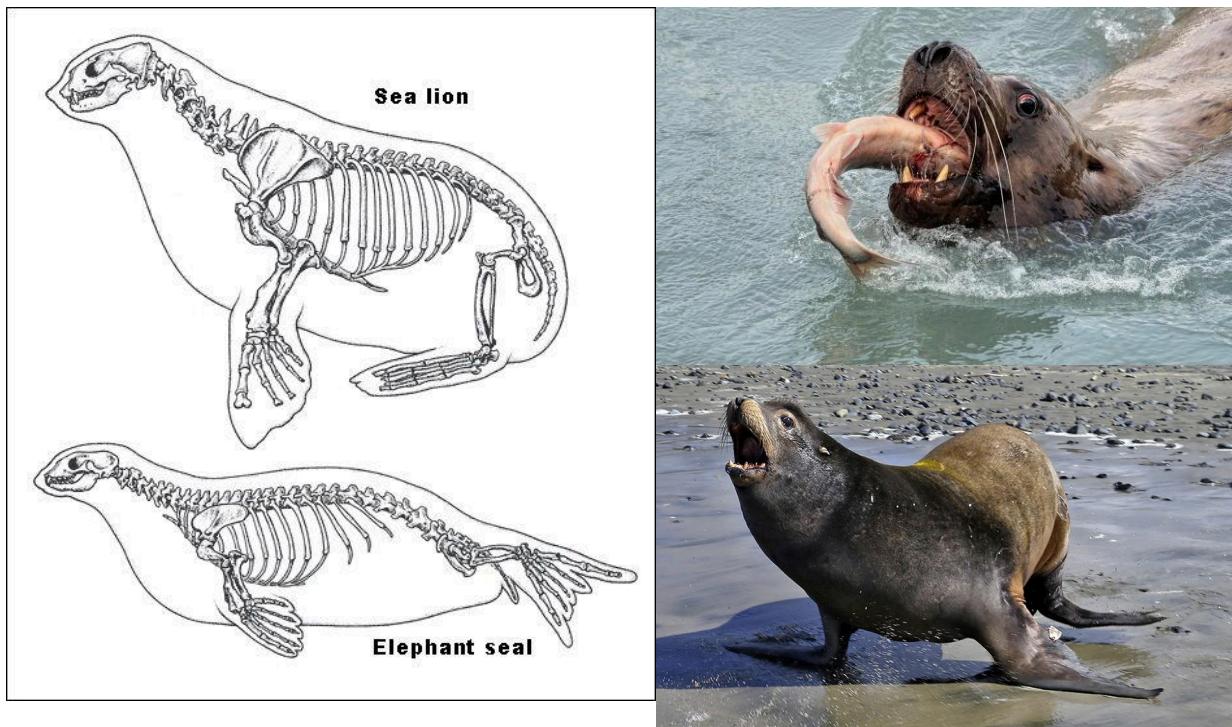
OTARIIDAE

56

Sea Lions, the newest and extremely successful family of the order. Found around the world, extremely intelligent, agile and adaptive. Otariidae evolved 15 million years ago, and have small ears, lending to their common name of eared seal. This is not particularly helpful to their hearing, and is likely a vestigial structure from their terrestrial days, their terrestrial days may have been more recently than the other pinniped family members, as they have more of a caniforme skeleton than their other pinniped relatives.

To aid otariidae in their aquatic lifestyles, they have higher hemoglobin and myoglobin. This, along with larger blood cells helps them to hold more oxygen in their blood, enabling them to hold their breath for significantly longer than terrestrial mammals.

Otariidae are polygynous and form harems of up to 15 on stretches of beach during mating season. Dominance is established with shouts and sometimes violence, causing varying degrees of sexual dimorphism.



EUMETOPIAS JUBATUS

57

Also known as the Steller's Sea Lion, it is native to the northern pacific coast of the Americas, along the northern pacific coast of eurasia, south to the korean peninsula.



They stay in shallower waters than phocidae and odobenidae, staying in the well lit waters where they can see their agile fish prey more clearly in the daylight. Because Jubatus is so agile and intelligent, they will sometimes form hunting packs and herd schools of fish to feed together more effectively, sometimes being so communicative as to involve dolphins in their strategies. This

requires quite an advanced social thinking brain. The heaviest Jubatus bulls grow to 2,500 lb, though they average 1,200 lb, while females 580lb, this weight difference primarily comes from the structure of the males, having more robust chest, neck and general upper body structure to help survive competing for mates.

ZALOPHUS CALIFORNICANUS

The California Sea Lion, the common name for *zalophus californicanus*. Staying closer to the continental shelf than the all other pinnipeds on this list, they are still very adept swimmers, capable of reaching 25 mph in bursts. They are significantly smaller than their northern relative, at a mere 770 lb, and more commonly under 500lb. Females can weigh as little as 220 lb. Though they are significantly lighter, they are nearly as long. This is because *californicanus* is in warm waters, where it doesn't need a thick coat and blubber to insulate. These seals have been found over 150 mile up stream in rivers, unlike most other pinnipeds.



PART FIVE

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carnivora

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URSIDAE

ARCTODUS SIMUS

60

Arctodus (better known as the Short-faced Bear) was the largest carnivore of the North American Pleistocene, at 1,800 pounds on average and at max 2,500. This also makes it the 3rd heaviest mammalian carnivore ever (behind another tremarctinae bear and a hooved monster). Unlike modern bears, who tend to eat a herbivore/insectivore diet; Simus was a carnivore. Standing at up to 6 ft on all fours, Simus had long, thin (for a bear) legs ideal for galloping over grassland, spending minimal effort, a great sense of smell to detect a kill from ~8 miles away; coupled with size (on hind legs standing up to 14 ft tall) sniff the fresher kills high in the air, and get a bird's-eye-view of its surroundings. Attached to those long, muscular legs were four 8 inch claws. Another feature to fear were its jaws, capable of putting down 2,000 psi; to give context, a wolf needs 700 (psi) to crack a moose's frozen femur. With tools like these, it would have been nearly unstoppable against other ice age megafauna.

Simus was a hypercarnivore (meaning a diet of 70%+ meat). Thought of by some scientists as "the T rex of the Pleistocene" because it is theorized that Simus would take the fresh kills from other apex predators, instead of trying to hunt on its own. This is because Simus was slightly thinner than modern bears for its size, coupled with its greater size it made the bear too heavy to hunt agile prey, and too small to hunt adult mammoths, mastodon, and *Eremotherium* (a sloth the size of a mastodon). Simus would have also used its great size to scare off any other hunters who might be at the kill.

This bear, like all bears, was solitary. Though it was solitary, it was not territorial. When faced with another bear, Simus would generally choose to ignore it rather than fight and risk serious injury or death, much like its closest relative the Spectacled Bear of South America which doesn't have a solid "territory", unlike the *ursus* genus. This is something curious, seeing as how it was so aggressive, and unafraid with other apex predators, and clearly knew that it was bigger and badder than anything else. Perhaps it just "couldn't fight everyone", and had to be peaceable with other bears to minimize the amount of wounds sustained.



URSINAE

URSUS MARITIMUS

61

Better known as the Polar Bear, it is the only true carnivore in its genus. Found throughout the Arctic Circle, and along much of the shoreline of the Laurentide Ice Sheet, this bear is probably the best adapted predator to the cold. They evolved some 0.5 million years ago from a population of Brown Bears which were separated from the mainland population. However, throughout their evolution polar bears have inter-breed with U. Arctos.

To aid in the Polar Bears winter time survival, bears are equipped with up to 4 inches of blubber. Their fur consists of two main layers: Guard hairs, which range from 2-6 inches in length, and are hollow, and an undercoat of softer, finer hairs. Polar bears grow to immense sizes, reaching 2,200 pounds in the winter in males, and standing 5 feet at shoulder, and 12 feet on their hind legs. However, females average just half the weight of males, at just 400 pounds. Polar bears' toes are webbed, to aid in swimming. They can also hold their breath for 3 minutes while swimming, and are capable of swimming for 62 continuous miles.



Polar bears primarily hunt seals, which are mostly fat. This highly concentrated energy source helps them heat themselves throughout the harsh winters. They hunt by waiting next to an air hole of a seal. When the seal surfaces, the bear pounces, pulling it from the hole and devouring it.

Polar bears are the only bears which don't hibernate, due to the length of arctic winters. They are also fiercely territorial, even with the opposite sex (except during mating season). Polar bear males are known to kill the cubs of a mother to put her into heat, in the hopes that she'll be receptive to him.



FELIDAE

xenosmilus hodsonae

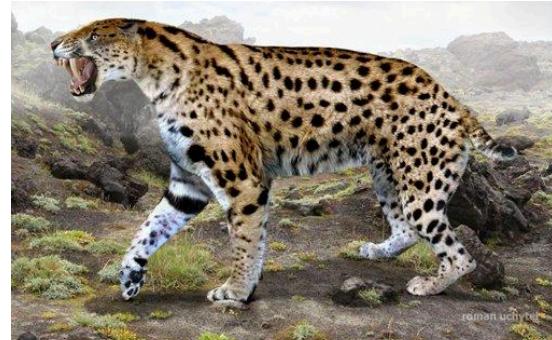
62

The largest North American cat you've never heard of, and if you have heard of it, it's still the largest North American cat. *Hodsonae* was also referred to as the "cookie cutter cat", for reasons I will explain soon. This cat was found in the south-eastern corner of North America, specifically in the Florida region. It existed from about 1.8 to 0.3 million years ago.

Hodsonae was the heaviest cat of the Americas by a significant amount, weighing in between 507 to 880 pounds, and standing 3.5 feet at the shoulder. Though it was hefty and relatively tall, *Hodsonae* was barely 6 feet long. This made it the stockiest cat to have ever existed, meaning it had no endurance and was very slow. Its jaws were wide and its snout was short. Within its large muzzle, it contained short (for a saber-toothed cat), very thick and robust teeth. These teeth lined up very nicely to create a straight line.

Hodsonae's build is rather perplexing for a hunter, its slow speed and little endurance made hunting small game impossible, while its short, robust teeth made attacking large game a very dangerous process. It would have had to rely on stealth, needing to creep extremely close to its prey at the very most in order to make consistently successful hunts. This would require dense ground cover, something like bush, or marsh in order to conceal a cat of this size at such a close distance. Its build made it clear it hunted very strong, robust prey, probably specializing in hunting the giant peccary, armadillos, and Tapirs.

Hodsonae's method of killing prey was most likely to restrain prey with its incredible strength, and then tear out a chunk of the prey, ideally its throat, but potentially somewhere on its body, paralyzing the prey with pain before it bled out, or died from lack of blood to the brain.



SMILODON FATALIS

63

Fatalis means fatal. This cat took a very different approach to hunting, however, as its name suggests, it was still very fatal. Fatalis is theorized to have leapt out from concealment, to land on the backs of prey, or tackle them to the ground, and minimize effort expended by running. Fatalis had the upper body strength of a bear, for wrestling medium sized game in pairs.

Once the prey was pinned they would sink their 7 inch canine teeth into the necks of the well-restrained animal, and

pull them out, cutting the jugular, trachea, and carotid artery, a nearly instant kill. To accommodate these gigantic canines as well as the neck of a bison, fatalis was able to open its mouth 60 degrees, 15 degrees farther than any felid alive today. However, this added range of motion came at a cost: bite force, just 440 pounds of it. However, adaptations came to the rescue again,

giving the cat a much more powerful neck, enabling it to press its canines into the throat of its prey using its thick muscular neck, doubling the bite force to 880 pounds.

However, these teeth were relatively weak against lateral forces, and could be broken if the animal struggled too hard while buried in its prey's neck. To help compensate, the cat's front legs and upper body were strengthened to help restrain the prey. It developed claws much larger and far more robust than modern cats to help it grapple with large, lively prey. Their hind legs were relatively weak compared to modern cats, only used to ground the cat and to leap out onto prey; vs the running method of modern big cats. Surprisingly, it was able to do this weighing as little as 360 pounds, however it's maximum weight ties it with Atrox at 770 pounds.

Fatalis had a smaller brain than modern cats, suggesting that their hunting strategies required significantly less planning and complexity than those of modern felids, and especially those of Atrox.

Fatalis hasn't been shown to be nearly as sexually dimorphic, meaning that they were probably not fighting each other for mates; or at the very least not fighting often. This would lead us to believe that they were very peaceful with each other, working in makeshift groups or hunting alone. Alliances were fluid, and partnerships not so long-lasting.



HOMOTHERIUM SERUM

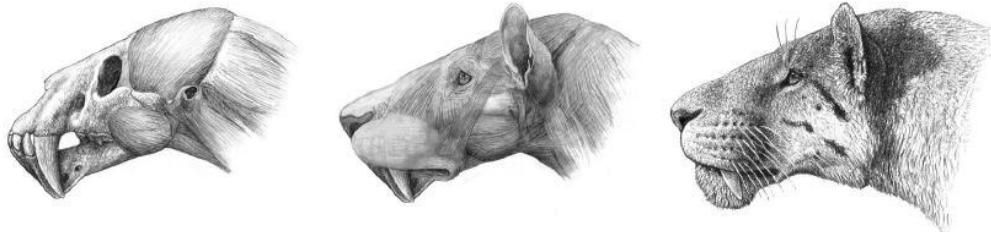
64

The diurnal hunter, unlike the other two cats it shared its family with. Serum had much shorter teeth than those of Smilodon, a relatively close cousin, but were flat and serrated, for cutting through thick hide, not a death grip. Also aiding its hide-cutting ability were their strong jaws, giving the pressure needed to cut through mammoth and mastodon hide. Unlike its cousin again, it had strong incisors for carrying its prey to their den (prey unique to its genus).

Unlike any cat alive or extinct, Serum is thought to have used its endurance to take prey, similar to wolves and Hyenas (which had similar proportions). The large nostrils would have allowed the lungs to be filled with air far more effortlessly than those of other cats. Its proportions, like those of a hyena, would have made galloping after its prey (mammoths and mastodon) easier and much more efficient than modern cats, which are better built for short bursts of speed, agility, and strength. This is also supported by its smaller hind legs, making it unable to leap great distances (something every other cat does to take advantage of surprise to its fullest). Instead, it was able to leap only a few feet.

Its large nasal cavity, which would have allowed for vast quantities of air to flow through its sinuses, a feature which also supports its diurnal behavior, would have also served as a coolant for its large and complex visual cortex; a feature found in cheetahs. All of these adaptations, in addition to the bones found in its cave sites (those of mammoth and mastodon) point to a highly specialized lifestyle of endurance-hunting large game, or being the giant killer, a niche left exclusively to Homotherium.

Surprisingly, Homotherium is the smallest of the apex cats of the Pleistocene, at 340 to 500 pounds, nearly the exact same weight as modern lions; to compensate, it would have formed the largest prides of the ice age felines, estimated to be over 40 adult individuals, 20 times more than either cat it shared the continent with. These prides were relatively unstructured, without an alpha or breeding pair.



PANTHERINAE

PANTHERA ATROX

65

Panthera Atrox means cruel cat. Cruel remains to be seen, but there is a strong argument for aggressiveness and cunning.

This cat was leo 2.0, weighing 400 to 1,080 pounds, the weight of a small horse and standing at least 4 ft at the shoulder, this was the largest cat by size, period.

Atrox was smarter than lions, possessing a brain larger by ratio than that of the modern lion, on top of being larger in both weight and dimensions. The cat has also shown to have a nearly 50/50 split of male to female. This leads us to believe that it was able to form complex, monogamous relationships; similar to a marriage. However, Atrox was more aggressive than modern lions, this is supported by the greater sexual dimorphism. Males were much larger than females, they had longer teeth and claws and were more heavily built, suggesting that they would fight to the death over mates more frequently than even modern lions.

Panthera Atrox also had larger teeth than a modern lion, at 4 inches, half an inch greater than those of today. Its teeth were made to puncture, like those of felines, and not to cut through flesh and hide like those of machairodontinae (knife-toothed cats). On top of these longer teeth, it had a much stronger bite, too, at roughly 1,500 psi. Their claws were slightly longer, and more robust for grappling with the hefty bison of old. Attached to those claws were longer, stronger, and more flexible legs. Its upper body is more similar to that of a bear than to a lion in range of motion, further aiding its ability to grapple with big-game. This also enabled Atrox to reach a greater top speed than a modern lion (near the 55 mph mark), and use its larger claws to maneuver prey with a wider range of motion. Atrox's bones were thicker, fortifying the cat, and allowing for more space for muscle to attach, increasing strength.

It was well adapted for open plains hunting, using its speed and agility to run down leaner prey. Atrox hunted primarily large ungulates, such as horse and bison. This method would look very similar to a pair of lions hunting, or a single tiger; ambush, speed and a bite to the throat to stop blood flow to the brain.



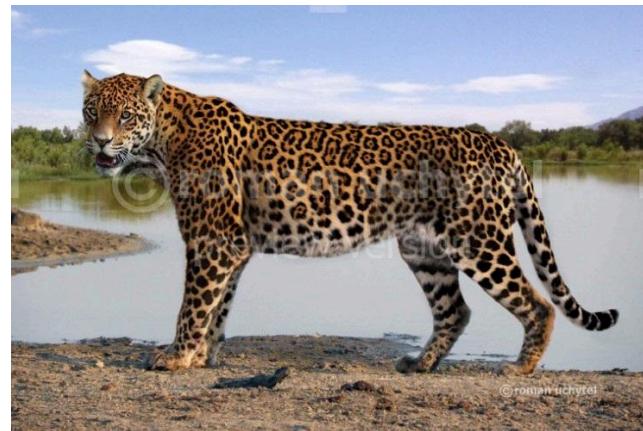
PANTHERA ONCA AUGUSTA

66

P. Onca (Augusta in North America), or the Jaguar, was endemic to the Americas during the Pleistocene, arriving long before the Cave Lion had even left Eurasia to enter Africa. Once they arrived 0.85 million years ago; much of its genetic diversity went extinct at the end of the ice age. However some still survive in the Amazon rainforest and in pockets of southern North America. Onca came to the Americas the same way every other pleistocene beast did, by crossing over the Beringian land bridge. Onca became isolated from the lion/tiger branch of the *Panthera* genus when they crossed the Bering Straits (Beringia). Onca was very flexible about what environments suited it best, preferring forests and bush, but also being equally successful on the open plains.

Because of their isolation, and their different environment, Onca was forced to change its physiology. Onca stood taller than its modern counterpart, at up to 3 feet at the shoulder. This added (6 inches) height came primarily from its longer legs. These longer legs enabled Onca to be capable of outrunning Cougars and rivaling the American Lion, at 53 mph. Though Onca had longer legs, they were still very brawny, and very capable of restraining medium sized prey. Its jaws also grew stronger, larger and more heavily built. Onca's skull was so heavily built that its bite force packed more punch than any other mammalian Pleistocene predator, with a whopping 2,200 pounds of force. Onca grew heavier than it does today, reaching weights of 300 in large males, and in small females weighing just 100 pounds, however large males can reach 420 pounds.

Onca was a solitary animal, and was very territorial (with their own gender). Onca would spring out from its cover, and tackle its prey, before restraining it. Then the cat would find the spine of its prey, and crush down with its awesomely powerful jaws, instead of going for the soft throat like all other large cats.



FELINAE

PUMA CONCOLOR

67

Better known as the Puma, Cougar, or Mountain Lion. It occupied the niche that Leopards fill in Africa and Eurasia today. They were by no means pushing Atrox or Fatalis around, though their prey species and environments overlapped. Cougars are incredibly successful predators, and masters of stealth. Their range is massive, spanning from coast to coast, and their diet varied.

They reached weights of over 250 pounds though they more normally weighed between 60 lb and 220 lb, males typically weighing 50% more than females. Pumas are thinner and longer than the other cats featured on the list, reaching 2 to 3 feet in height at the shoulder, and reaching 5 to 9 feet in length (with the tail). Their tails are long, aiding in maneuverability during high speed chases, and can reach over 3 feet in length. They are able to reach a top speed of 50 miles per hour, and they are able to leap 18 feet vertically, and 40 feet horizontally.

Concolor was a solitary animal, with a great deal of sexual dimorphism, males being larger, stronger, and proportionally larger claws and canines teeth. Males have the highest rate of same species aggression and fatality rate.

Able to ambush, outrun, and out-think most other animals, Cougars are incredibly flexible in their environment. Capable of hunting in dense forests, and wide open grassland, and even nigh desert conditions. With their incredible abilities to leap they are able to sneak up on bull elk and even black bears, and take them down with a well placed bite to the neck. Cutting off the blood supply to the brain, for a quick kill. However, when large game wasn't available they were able to hunt rabbits, fox, and other small game. Concolor were still far from the top of the chain, and had to drag its kills into trees to consume them, away from the clutches of larger predators; an impressive feat of strength in my opinion.



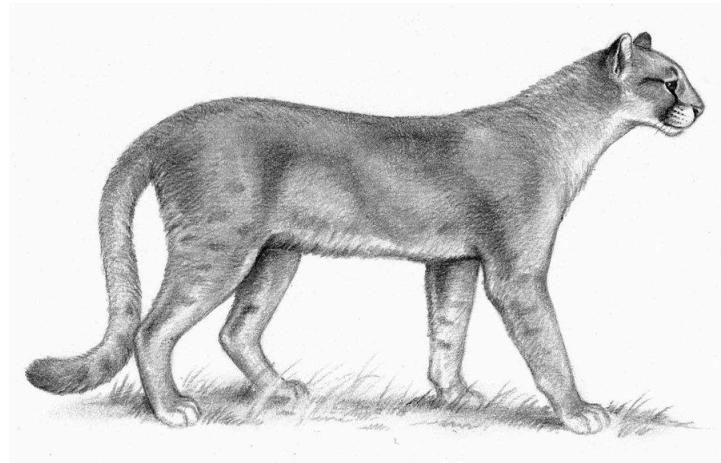
MIRACINONYX INEXPECTATUS

68

Better known as the American Cheetah, though it is closer related to the Cougar. It earned this name because of its cheetah like build, though it likely seldom hunted in this way. Inexpectatus first evolved about 3 million years ago in Texas, where it spread quickly to California. As we entered the Pleistocene, it spread throughout the south west, and made its way up the east coast.

Inexpectatus was roughly the same size as the modern Cougar at 3' 3" feet tall, though it was leaner weighing just 200 pounds. This made the Cheetah faster, while still maintaining its strength, enabling it to hunt deer, goats and sheep. It primarily lived in challenging environments for larger, and less coordinated animals rocky slopes and couldn't traverse, functioning more like a Snow Leopard than an actual Cheetah.

Trumani and Concolorous together took Inexpectatus's niche.



MIRACINONYX TRUMANI

Much closer to an actual cheetah in build, though technically farther from them genetically, as they branched from Inexpectatus in the second half of the Pleistocene, before going extinct roughly 12,000 years ago.

Trumani was unable to fully retract its claws, and had an even lighter build, making it even faster. This enabled Trumani to be able to catch Pronghorn, the second fastest animal alive. Trumani also had a second population, slightly better adapted to the desert slopes found in the Southwest around Nevada and Arizona.



canidae

canis dirus

69

America, during the Pleistocene, was very similar to Africa today. We had lion (equivalents), elephant (equivalents), and crocodile (equivalents), and this is our hyena equivalent. They were about the same size as a modern Spotted Hyena, and like hyenas, their power comes not from their paws and size, but from their jaws, and numbers; coming in packs of 30 at the minimum (three times that of the Gray Wolf's average).

(lupus front left, dirus rear right)

Dire Wolves packed a bite force 30% stronger (than a Gray Wolf's), making it 910 pounds of force.

Dire wolves had smaller brains than

those of their smaller cousin, the gray wolf, like those of hyenas. They also were much bulkier, a modern wolf, at 3 ft tall, would weigh roughly 135 pounds, a Dire Wolf would weigh 175 pounds at the same height. Dire wolves would have been very similar to hyenas, both in build and behavior. But a major advantage they had over the Hyena was its rear legs, Dire Wolves have much stronger rear legs as they were canids, which would have made them fast and dart-like compared to its bulkier prey, and luckily would have kept the upper-body strength gains of the increased weight, aiding in securing everything from white-tails to 4,000 lb bison (pg32); making them a highly effective middle ground between the modern Gray Wolf and the Spotted Hyena. Truly a predator to be feared. A single pack of Dire Wolves could have over 40 mouths and combined weight of over 2.5 tons, a truly incredible force to be reckoned with. This also made Dire Wolves more flexible, being able to surround, chase, out maneuver, or wrestle prey to the ground.

Their packs were more loosely structured than those of modern Gray Wolves, and it is assumed that they had many breeding pairs at a time, opposed to gray wolf dominant pairs having the right exclusively. They would have had less of a pecking order due to their large kills allowing for access for more wolves at a time, more like African Wild Dogs, or again, the Spotted Hyena. They most likely would splinter off into smaller groups (especially during hard times) for significant amounts of time; as they were apex predators and feared nothing.



canis beringia

70

Canis Beringianus is currently an unnamed species of wolf endemic to Beringia (the land bridge between Russia and Alaska), south-east to Wisconsin, these wolves were seldom found outside of the tundra where their group tactics were effective in catching . The Beringian Wolf separated from the Gray Wolf just 0.045 million years ago. They are thought to be a sister taxa to the Gray Wolf, but they did not assimilate at the end of the ice age, going extinct about 0.01 million years BP.

Canis Beringia was stockier than modern wolves, especially in the head. It would have stood up to 3 feet at the shoulder, and weighed between 110 and 150 pounds. Some of this

additional weight is likely due to their very dense, multi-layered coat. Their jaws were more robust than any other member of their genus, leading me to believe that their bite force would have been north of 1,000 lbf. In addition to having a more robust jaw, Beringianus also had much more robust dentition, specifically in its rear molars (those used to crack large bones).

Due to the Beringian Wolf's skull design and isotopes found in its bones, it is thought that this wolf was primarily a scavenger, eating the largest game alive at the time, Wooly Mammoths, as well as the runner-ups, such as the bison and sloths. They were also thought to have lived in larger packs than modern wolves, numbering at least 15 members, and potentially rivaling the size of Dire Wolf packs (40 members). With a pack this size, they would have been significantly less organized, and not as tightly knit as their smaller, gray cousins. Though its more robust body would have also allowed it to hunt, even enabling it to hunt its gargantuan prey should their packs grow large enough.



canis lupus

71

Canis Lupus, or the Gray Wolf is the newest predator to North America, and by far the smallest of the predators on this list. It lived fleeing the shadows of giants, typically found in the woods, but also on open land, seeking elk and bison; keeping well away from the largest game, and more importantly, the largest predators. Its hunting strategies were very unique, enabling it to hunt game much heavier than it.

Lupus reached weights of 175 pounds, but more commonly weighs between 80 and 120 pounds. They are by far the lankiest animals included too, reaching 3.2 feet at the shoulder, and reaching 5.5 feet in length, tail included. Its tail grows to 1.7 feet in length.

Wolf packs range from 5 to over 40, but on average consist of 10 wolves. Each pack contains 1 dominant, breeding pair. The other members are typically juveniles, children of the dominant pair who have yet to leave and try to make a pack of their own. The dominant pair will eventually kick out its children, as they become sexually mature, and present themselves as a challenge to mom and dad.

Wolves top speed is just 43 miles per hour, but its endurance is second to none. Their endurance is their hunting strategy, when hunting large prey items. Their onslaught can last for 36 hours. Dancing around their prey, nipping, clawing, and tearing when the opportunity presented itself. Death by a thousand cuts, the dance continues until the behemoth prey item collapses from blood loss and exhaustion, before the pack finally descends upon the already half dead meal. Not a pleasant way to die, but a very effective hunting strategy. Enabling a pack of just 10 large dogs can take down a bison or camel over a ton consistently. The pack has a strict pecking order, the alphas and pups eat first, and then the rest of the pack. Gray wolf packs are known to defend their kill from rivals as large as a U. Arctos.



canis rufus

72

The Red Wolf, North America's native rival to the Gray Wolf. Evolving 1.7 million years ago, they dominated their niche, found from the everglades to the Laurentide Ice Sheet, and west to Texas. They most likely preferred forests and swamps where the giant predators were least common, but were very capable of hunting on the open lands as well.

The Red Wolf is very lightly built to aid in its endurance. Red wolves grow to a length of 4 feet and a height of 3, weighing between 40 and 90 pounds. The Red Wolf was, however, faster than the Gray Wolf able to reach 46 mph. They live in medium sized packs, with the same social structure as their larger eurasian cousins, as well as having a similarly sized pack, at roughly 8 wolves.



canis lycaon

Also known as the Eastern Wolf, branched out from the Rufus ancestor just 140,000-300,000 years ago. Being so closely related, Lycaon was very similar in build; namely being very thin with a large chest, ideal for endurance running. This limited the wolf to smaller game, usually White-tailed Deer, though they do also attack moose, elk and Beaver. This wolf was found throughout the great lakes region, and eastward to the east coast, north to Ontario, and along the St Lawrence Seaway, and south to Connecticut.



HYAENIDAE

CHASMAPORTHETES

73

Chasmaporthetes *ossifragus*, which in the name of simplicity will be referred to as the Running Hyena was a hyena which, unlike the modern Spotted Hyena, was better adapted for running than it was for more combative hunting methods. It had longer, more slender legs and was likely capable of running over 50 mph. Being a hunter which relied on its speed, Running Hyenas preferred open lands to the forests found in the



north and east of the North American continent. It evolved in Eurasia, and reached North America about 5 million years ago, among the first to cross. Here they had no competition for the antelope and other extremely fast plains animals, and were extremely successful until the cats crossed 2.5 million years later, slowly pushing out the hyenas until their extinction 710,000 years ago. Before the cats, they were the apex predator from the Yukon to the Missouri River valley

Unlike spotted hyenas, Running Hyenas did not live in dire-wolf sized packs, and may have even been a solitary hunter. This is because fast game is smaller, not large enough to sustain the biomass of a pack; while the individual wolf may only reach 200, the pack weighs 5,000 lb. The Hyenas weighed 70 to 130 lb, and like modern hyenas they have a stronger bite for their weight than most mammals, however they also had a smaller brain to make room for the jaw muscles.



MUSTELIDAE

ENHYDRA

74

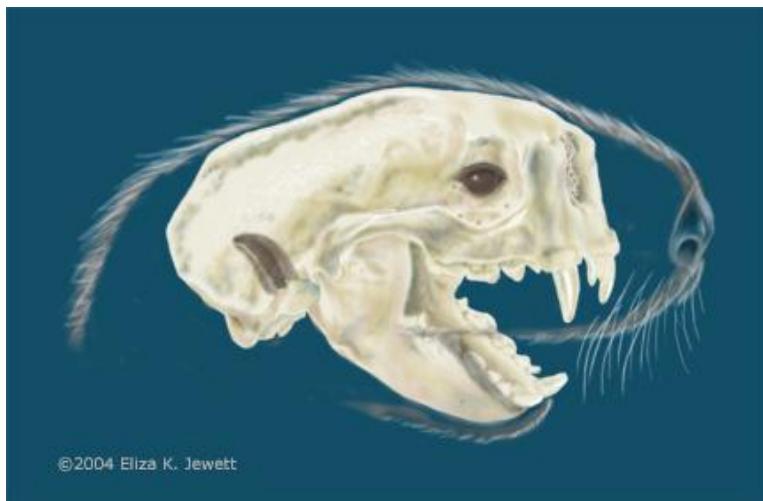
Sea Otters, a prolific genus in the Pacific Ocean, diverged from African and Eurasian Otters 5 million years ago, at the boundary between the Miocene and Pliocene. They began in the Pacific Ocean and later separated into three species. These species of Enhydra spread as far as the eastern Atlantic, in Europe. Enhydra

Enhydra were extremely successful and well adapted to live in the ocean their entire lives. They developed powerful jaws and a large brain to use their paws and jaws

to crack open clam shells, which is something very few animals can do, creating a new niche for carnivores. Enhydra's ability to make more complex plans to access food is extremely helpful in staying away from other larger marine predators and also in finding new sources of food. Their skull is shaped with the eyes and zygomatic arch, allowing their skull to stay narrow, and still

giving room for a large brain in their extended parietal and/or occipital. This is a feature common to mustelidae members. This also gives their temporalis extra room to attach to the skull boosting their bite force. The only drawback is their eyes are much closer to the tip of the business end, putting them in harm's way.

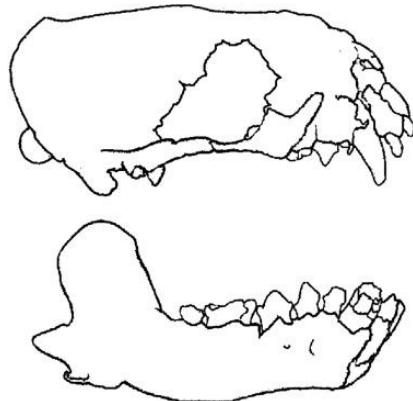
Enhydra undulates its body and tail, which are flattened to move forward, like other aquatic mammals, such as pinniped, sirinae and cetaceans. Though they can live their entire lives at sea, they are still able to walk and run on land like their other mustelidae relatives.



E. MACRODONTA

75

The Macrodonta species is the one which evolved in North America during the Pleistocene. It is only known from a few jaw fragments, which it gets its name from. Its teeth are larger than the eastern species, possibly indicating them pursuing larger prey, or using their teeth to crack the shells instead of tool use, because their brains are smaller. They went extinct around the late Pleistocene, likely another casualty of the Younger Dryas. Macrodonta is almost the exact same size as the existent sea otter, though its skull is more robust, weighing up to 120 pounds.



E. LUTRIS

Also known as the Sea Otter, originating in the northern Japanese islands, and the Eastern coast of Russia. They are extremely intelligent and curious. Lutris were able to fill the vacant range of the extinct north american population (macrodonta) within a few thousand years.



Lutris feeds primarily solitarily, as adults though adults do teach their young how to fish. When they rest, they gather in groups which are called rafts, and include up to 100 individuals. Lutris separates their rafts by gender, female rafts tending to be smaller than male rafts. Most males hold a small territory which they patrol, however many who aren't able to hold territory stay in large male groups and migrate around without a defined territorial boundary.

Lutris is larger than smaller wolf species at 50 to 100 pounds, and capable of weighing as much as 120. They range in length from 4 to 5 feet. Lutris doesn't have anal sacks, like other Mustelids, and it is very slow on land, though they are more mobile than any other mammal which is as aquatic.

GULONINAE

GULO

76

Gulo contains several species of Mustelid, most of which are extinct. Gulo evolved in North America during the early Pliocene, 4.5 to 4.9 million years ago, diverging from their most closely related cousin, the Fisher (another incredible mustelid). Theory evolved in warmer climates, and eventually adapted to the extreme cold where the only existent species is found.

GULO GULO

The Wolverine, the smallest mammalian apex predator of any true continent. They are extremely successful, growing to their largest sizes after the Glacial maximum, when the Pleistocene ecosystems were in decline. This indicates that whether the ecosystem was doing well or not for other species, the wolverine was able to thrive. Gulo are found throughout North America and Northern Eurasia.

Gulo are known for their aggression and boldacious attitude, however they are extremely intelligent. They hunt in different styles, and play like crows in the snow. Gulo is also the only apex mammalian predator except humans where the father takes an active role in parenting, oftentimes keeping in touch with their children after they become sexually mature and playing together. Of course we're all aware Gulo is an incredible hunter, capable of killing everything from moose to small bears, wolves and likely even mountain lions. They use strategy to maximize damage, use scent and sound to intimidate their opponent into forfeiting or not fighting back. Gulo also uses trees to get a better angle on large prey, able to leap from branches onto their prey's neck, and biting down with their vice like jaws.

Gulo is rather small for an apex predator, at just 20 to 50 pounds. The largest wolverines have weighed over 80 pounds. They measure 2 to 3 and a half feet in length. Gulo has some extreme cold adaptations, their coat is so thick they can lay on the snow and don't melt it. Their paws are also so large they don't fall into fresh pack snow, acting as snow shoes.



REPTILIAN MEGAFauna

CROCODILIA

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CROCODYLIA

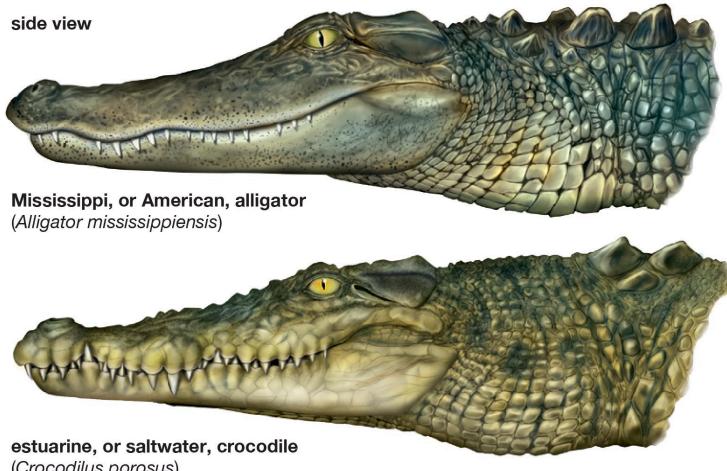
79

Unlike most of the other animals on this list, Crocodilians have refined the same shape in the same habitat since the first dinosaurs, 235 million years ago as Crocodylomorpha. However, the only living branch of this superorder are the crocodilians which evolved about 93 million years ago as the family alligatoridae. The anatomically modern crocodiles evolved 55 million years ago.

Crocodilians of the North American Pleistocene inhabited deltas, estuaries, slow rivers, swamps, and eutrophic lakes. Some of the most productive habitats, but also the most competitive. To survive the diseases of this environment crocodilians evolved a special blood plasma. Their plasma ruptures the cell wall and destroys the RNA of anything that contacts it in seconds, stopping everything from prions to fungus and eukaryotic blood borne parasites like worms. The only place parasites can exist is in their stomach, eating food from the crocodiles kills. A relatively benign parasite in the scheme of swamp parasitism.

Crocodilians also have a complex brain capable of planning and learning. They aren't born with the strategies for hunting, though they are innately aggressive. Crocodiles learn how to catch birds, fish, bison, as well as their daily and annual habits. Crocodiles have been seen stalking prey for weeks and use new tactics to take new prey based on those observations. In addition, though crocodilians are generally solitary they have a 22 word language, which is the same as crows, which is another indicator of intelligence.

On top of these abilities the crocodilians have evolved a powerful sense of smell within their long snout. This snout also is covered in pressure sensitive dots to detect prey movement in the water. Crocodilian eyes have a special layer of crystal behind the retinas which reflects light back through the retina allowing it to be absorbed twice. In addition to all these senses, crocodiles when lining up for an attack will slide their liver up and down their body cavity to change their angle of approach without disturbing the water to line up for an attack.



estuarine, or saltwater, crocodile
(*Crocodylus porosus*)

CROCODYLIDAE

80

American Crocodiles are descended from *crocodylus* clade as *crocodylus suchus* and *crocodylus niloticus* from Africa, traveling across the Atlantic about 7 million years ago.

CROCODYLUS AUCTUS

The American Crocodile is the most physically similar to the Nile in both shape and niche, reaching similarly titanic sizes, of 22 ft and a metric tonne (2,200lb). At this size, these beasts would have been taking medium megafauna such as turtles, holmesnia, sloths, deer, basically anything less than 2/3 its weight would be on the menu to be dragged underwater and torn apart by the crocodilians signature move, the death roll. Their range starts in northern Mexico and ends in the northern Amazon river basin.



CROCODYLUS MORELETII

Morelet's Crocodile is another 2nd trophic tier crocodilian, measuring in at just 15 ft and under 1,000 lb. They are slimmer than the other crocodilians on the continent, better suiting them for a pescitarian diet. This allowed them to grow into an ecological niche with less competition than the apex predators of the pleistocene. They are found around the Yucatan peninsula.



CROCODYLUS RHOMBIFER

The Cuban Crocodile is native to the West Indies. They're significantly smaller than their more marine counterpart, *Acutus* at just 11 ft and less than 480lb. To make up for this they developed a unique behavior amongst crocodilians, group hunting. They'll set traps, restrain prey to help each other get the death grip.



ALLIGATORIDAE

81

Alligatoridea is the family of Alligators and Caiman, the oldest crocodilians evolving 93 million years ago in North America, and from there crossing the early Pacific to Asia and South America. They have broader U shaped snouts, with the teeth on their lower jaw being hidden by their upper jaw. They can tolerate the cold better than other crocodilians.



ALLIGATOR MISSISSIPPIENSIS

The American alligator is designed to hunt large, armored game with its more robust snout. Even though they are slightly smaller than their southern relatives, they still reach 2,200 lb and 19 ft. At this size, their bite force would have been well over 8,000 psi. This is enough force to crush the skull of a small bison, though their favorite prey are turtles. The American Alligator is found throughout the Gulf States.



CAIMAN CROCODILUS

Better known as the Spectacled Caiman, is found from southern Mexico to the southern border of the Amazon River Basin. They are the smallest crocodilian in North America, rarely reaching 100lb and 8ft in length. They are more agile on land than the other species. Their smaller size allows them to inhabit waters too small or temporary for their larger cousins.



TESTUDINES

DERMOCHELYIDAE

DERMOCHELYS CORIACEA

82

The Leatherback Sea Turtle is the largest surviving turtle species, a holdover from the mid Cretaceous period, unchanged for 110 million years. They are the last of an ancient type of turtle, with no close living relatives. Though Coriacea are the last of their kind they are still wildly



successful, found in all oceans from the polar seas to the equator. They have survived this long because they can hide from predators by diving in excess of a kilometer in search of their favorite prey, and an equally prehistoric animal, Jellyfish. In these jellyfishing expeditions, they'll travel up to 12,000 miles in 647 days (at sea). Coriacea are also more thermally flexible than most other reptilia species, actively hunting in water only 32.7 degrees fahrenheit, this is because they have the unique ability to generate and store heat.

Coriacea get their name from a very unique physical characteristic, they don't have a traditional carapace made of scutes, theirs is primarily thick skin with small osteoderms. This carapace has seven ridges running front to back. This does leave them slightly less protected than their newer relatives, however their enormous size, of up to 2,000lb protects them from small and medium sized oceanic predators, though on land their fins make them a sitting target. Coriacea's carapace grows to 8ft. They more regularly grow to the weight of a horse, 600 to 1,500lb and 5 to 7 ft in shell length. Their throat is distinct as well, having large barbs pointing backwards towards their stomach to keep prey from escaping, or touching their throat with their poisonous tentacles.



CHELONIIDAE

83

The modern Sea turtles family, evolving 58 million years ago. They prefer warmer waters than their older relatives. Chelonids are most easily differentiated by their carapace, which is the more common fused scute design. This offers them significantly more protection against sharks, but also makes them slower. Still, they only come to shore to lay eggs because they are so poorly suited to land based movement. However, over time thermal tolerances should improve, allowing them to inhabit the extreme polar seas that have been historically reserved for leatherbacks.



CARETTA CARETTA

84

Caretta is the Loggerhead Sea Turtle, the largest of the Cheloniidae family, usually weighing between 200 to 500lb, but capable of reaching 1,200lb. These sea giants are found in every non-polar ocean in the world. Their success is due to their omnivorous diet, eating anything slow enough to be caught in their beak, from fish to algae. Their size protects them from most of the predators found in the coral reefs they feed in and around.



CHELONIA MYDAS

Chelonia, the Green Sea Turtle. Mostly herbivorous, found around the world, with a greater cold tolerance than their larger cousin. They reach sizes of up to 900 lb, but are regularly between 15 and 600. They have a smoother shell than their relatives and also gravitate to the coral reef's amazingly productive ecosystem. They are one of the most common sea turtles in the world.



LEPIDOCHELYS KEMPII

Better known as Kemp's Ridley Sea Turtle, is the smallest sea turtle of North America at just 3 ft long and 110 lb, but generally smaller. They have the smallest range, only found along the Atlantic and Gulf coast.



TESTUDINIDAE

GOPHERUS HEXAGONATUS

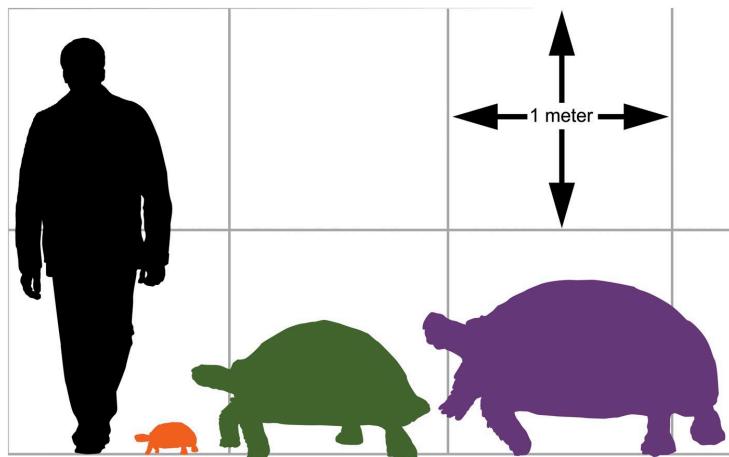
85

Gopherus is a genus of burrowing tortoise native to North America. You might be surprised to find that these turtles definitely take the 2nd place for North American testudines in terms of family rank. These giants match anything alive today, at over 700 lb and more than 4 ft long. They were the size of large galapagos tortoises, unlike the giant tortoises of today, these horse sized reptiles dug burrows to escape the light frosts of the winter months in the southwest, predominantly the Rio Grande basin, and south through the arid savannas of Mexico. These burrows also enabled them to protect themselves and their nests from predators, able to block their enormous tunnels with their impenetrable carapace.



HESPEROTESTUDO CRASSICUTATA

Gopherus's smaller cousin, though still enormous by modern North American standards, at over a meter in length and weighing close to 400lb. These large tortoises were more widespread found in Florida in addition to the Rio Grande and south. They also burrowed to avoid frosts, making them and their eggs common fossils to find because they would collapse entombing them for paleontologists to discover many millenia later. Of course they were herbivorous, using their strong beak to cut through woody plants.



CHELYDRIIDAE

MACROCHELYS TEMMINCKII

86

The Alligator Snapping Turtle is another living fossil from the swamps of the southern USA. These monsters call the Mississippi watershed their home. Amazingly, they don't need to hibernate to survive Illinois winters. *Temminckii* have survived since the Miocene, more than 15 million years ago. Though for reptiles they are a newer species, they live longer than almost any living thing on the planet, with individuals definitely living for at least 2 centuries but potentially 3 or 4 (centuries). We know this because we have found civil war era musket balls in the shells of 150lb turtles, which means they were already larger turtles during the civil war.



Temminckii can reach sizes of up to 250lb and possibly up to 403lb. To support this dense mass they are primarily aquatic, spending most of their time in swamps and marshes; with their mouth open, waiting for an unsuspecting fish to come and nibble on their tongue, which acts as a lure, mimicking a worm. This allows these turtles to catch fish without expending significant amounts of energy. *Temminckii*'s beak has enough force to cleave through any animal unfortunate enough to get caught. Like the alligator, these turtles have an incredible bite force of over 1,100psi in turtles as small as



100lb. Unlike the crocodilians, its bite shears through things instead of punching holes, making it better suited to fishing than hunting, as the limb detaching allows the animal to pull away from the turtle, avoiding becoming a meal for the turtle.

CHELYDRA SERPENTINA

87

Though quite common these creatures are still quite miraculous. They are wildly successful throughout the Americas, the common snapping turtle evolved from the same common ancestor as the Painted, Red-bellied Slider, and Alligator Snapping turtle, separating in the Miocene. Serpentina can reach over 75 lb, and reach over 5 ft in length including their tail and neck. Serpentina's neck is so long they cannot retract their head, however this enables them to reach around and almost extend past their rear legs. Their neck, when extending opens like the pouch of a pelican or fish to create a vacuum which sucks prey into their mouth. This makes them effective active hunters, however specializing in a stretchy pouch where muscular tissue attaches means their bite force is weaker proportionally to their larger relative, temminckii. Their bite force is likely weaker than a humans,

Serpentina's success is due to their versatility, on land they are slow, but in the water they are very adept swimmers, capable of chasing down frogs, tadpoles, slow fish, other turtles, and they are omnivorous, so they eat the abundant flora in their swamp habitat. This enables them to fill whatever ecological niche is available in their environment, until they reach a size where they no longer have to worry about aquatic or even most terrestrial predators. Their ability to overwinter also enables them to occupy places farther north where there is less competition but the swamps are still fertile.



TRIONYCHIDAE

APALONE FEROX

88

The Florida Softshell turtle, like its smaller north/eastern cousin, Ferox can inhabit any mesotrophic or eutrophic body of water. They are stuck primarily to the tropics of the southeast, mostly Florida and some of the states which border. Ferox is primarily a predator, and is generally a secondary predator in its environment as an adult. They are an ambush predator, laying flat on the bottom of bodies of water for prey to swim over, so they can extend their enormous neck and swim up towards their prey. They can eat anything under 20lb as a large adult.

Ferox can reach weights of up to 96lb, and reach a 30 inch carapace. As their common name implies, their carapace isn't made of scutes, it's made of a mildly flexible, leathery skin instead. This helps them hide and move, but at a significant loss of protection. In the shallow swamps they inhabit, they are usually safe as an adult. And being strong swimmers, they are able to run from predators such as alligators and crocodiles. One of their most unique abilities is that they have the ability to breathe air, and to some degree water. This helps them stay hidden from terrestrial and aerial predators who look for surfacing animals.



AQUATIC MEGAFauna

(FISH)

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ACIPENSERIFORMES

ACIPENSER

92

Acipenser is a genus of Sturgeon endemic to North America, they include the White, Gulf, Green, Lake, and Shortnose Sturgeon. They feed on benthics, small fish, and carcasses. They use their barbels to detect their food and identify what they are about to eat, along with their sense of smell.

Sturgeon are the largest fish found in North America's freshwater systems, reaching immense sizes. They are ancient, having existed for 200 million years (20 million years after the first mammals, and 25 million years after the first dinosaurs) and certain species have existed for 70 million years. This has helped them evolve to have some of the longest lifespans in the world, many species reaching well into their hundreds. Their bodies are covered on bony plates which serve as armor, while their skeleton is made mostly of cartilage (though they are a "bony" fish).



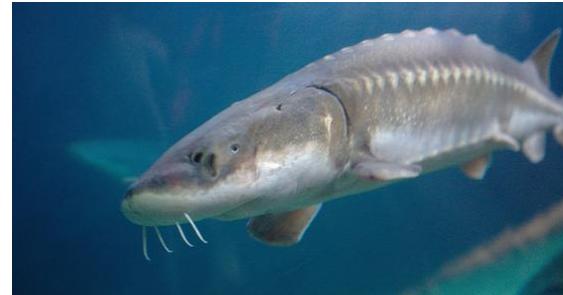
The adults spawn in deep river mainstems on cobble, which their highly adhesive eggs stick to. Clean, cold water (which can hold much more oxygen than warm water) is important to their embryonic development.

ACIPENSER TRANSMONTANUS

The largest freshwater fish species in North America, growing to an impossibly large 20 feet in length, and weighing 1,800 pounds (0.9 tons). To reach this size, it must be near or beyond the maximum recorded age of 104 years old.

They live along the western coast of North America, from California, to British Columbia, and to a lesser extent Alaska. There are isolated populations found in lakes in Alaska, and reports of giant fish so large in the Mackenzie River system, they must have been this sturgeon. They prefer to live in deep, slow rivers, estuaries, and some large lakes with connecting rivers.

They are opportunistic bottom feeders, primarily feeding on the remains of other fish, but also eating crustaceans and mollusks. They are not active predators, but are known to jump. Their reason for jumping is not known.



ACIPENSER OXYRHYNCHUS

93

The Atlantic Sturgeon, found from Florida to New Brunswick. During their juvenile stage stay in the river systems they were hatched in. As adults they are primarily found in estuaries and near the shore, staying in 30 to 165 foot deep water. Like all



sturgeon, they go up rivers to spawn. Depending on temperature and sex, reaching sexual maturity can take 5 to 30 years. They are known to live for up to 60 years. Atlantic Sturgeon are known to reach 15 feet in length, and weigh over 800 pounds (0.4 tons). Though they more commonly grow to between 7 and 9 feet, and weigh between 200 and 350 pounds (0.1-0.175 tons).

ACIPENSER MEDIROSTRIS

The Green Sturgeon is found from northern California to British Columbia's west coast, with occasional sightings in Alaska. They are also more commonly found in marine environments, and are the most marine oriented of all sturgeon found in the Americas. They grow to just over 7 feet, and can reach 350 pounds (0.175 tons).



Green Sturgeon are not found in exclusively freshwater, like their larger cousin the White Sturgeon, who they share their range with. It takes them a minimum of 15 years to reach sexual maturity. Green Sturgeon can reach an age of 70 years.

ACIPENSER FULVESCENTS

94

Better known as the Lake Sturgeon, it is the largest freshwater sturgeon of North America, reaching a weight of 310 pounds (0.155), and a length of 8 feet. They are found throughout the Great Lakes basin, and as far south as Alabama and Mississippi the Mississippi river system. They are common in large lakes and rivers throughout the region, and may even be found in some smaller connecting bodies such as straits and creeks.



Lake Sturgeons reach sexual maturity between 15 and 33 years, and only spawn every 4-9 years. When they spawn however, they lay hundreds of thousands to the low millions of eggs, over 10% of the fish's weight. They are also the longest-living species of Sturgeon in the world, reaching 153 years of age.

SCAPHIRHYNCHUS ALBUS

The Pallid Sturgeon is found throughout the Mississippi river system, from the delta to Montana. This species has existed since the late Cretaceous period, making it one of the oldest fish species in existence. They "only" reach 5 feet in length, and with a maximum weight of 85 pounds. They do not begin egg laying until they are 15, after which they lay every 3 years with decreasing frequency and increasing egg-count. The Pallid Sturgeon can live for over 100 years.



Pallid Sturgeon are only found in rivers, preferring medium to large, and a moderate to swift current. Unlike other sturgeon, they like turbid, warmer waters; but like most sturgeon they prefer sandy bottoms. They may prefer these waters because they eat smaller fish, the reduced visibility making their hunting easier.

POLYODONTIDAE

POLYODON SPATHULA

95

The American Paddlefish, a large, freshwater, filter-feeder. It developed a large rostrum to electronic pulses emitted by plankton, specifically zooplankton. This rostrum is so sensitive that it has replaced their eyes as their main sensory input. They still have eyes, but hardly respond to overhead shadows and changes in light, let alone shapes and colors. Their electrosensitive pores continue down to above the eyes, and the gill covers (operculum flaps)



They are found from Yellowstone to Montana to New York (including the Great Lakes Basin), down the East Coast to North Carolina, and from Alabama to Texas. American Paddlefish are highly mobile, individuals are known to travel up to 2,000 miles in a river system.

American Paddlefish don't reach maturity until they are between 7 and 9 years old, and can reach an age of 30 years. They can grow to a length of 7.25 feet, and reach a weight of 200 pounds, however they rarely grow longer than 5 feet. Like their distant cousins the Sturgeon, Paddlefish have a skeleton primarily made of cartilage. American Paddlefish are the oldest species in North America, existing for 300 million years, which places them in the Carboniferous Period (before the Triassic), 80 million years before mammals, and 75 million years before the dinosaurs. We are just 65 million years away from the last dinosaurs, to give some perspective.

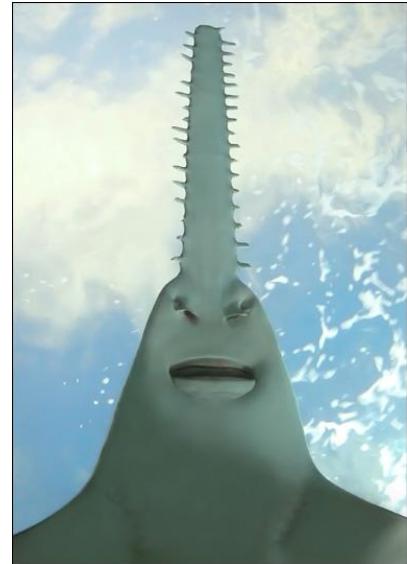


PRISTIFORMES

PRISTIS

96

Pristiformes are better known as sawfish. They are primarily found in the ocean, but are regularly found in estuarine environments. Sawfish grow to immense sizes, upwards of 23 feet. They have an elongated rostrum, lined horizontally with teeth. The rostrum is typically about 1/3 the animal's length, reaching a length of just over 8 feet. Sawfish rostrum functions as x-ray vision, it is covered with electrosensitive pores, which detect the electronic pulses put out by every living organism's nervous system and movements. They use their rostrum to dig for mollusks and other buried prey items. It is also used infrequently to slash through shoals of fish, cutting them into bite sized bits, and disabling them from fleeing the sawfish jaws. Their rostrum also functions as a great defense from predators, using it as a spiked mace, capable of inflicting deep gashes and serious blunt force trauma on a would-be attacker. Sawfish grow their entire lives, and therefore the largest specimens are also the oldest.



(Pectinata left, Pristis right)

P. PRISTIS

The Largetooth Sawfish (or Common Sawfish), the heaviest sawfish of them all. Measuring 25 feet at its maximum, and weighing 1,303 pounds. Large adults have been known to enter fresh water for extended periods of time to feed. They are known to live for up to 80 years.

P. PECTINATA

The Smalltooth Sawfish, equal in length to their heavier cousin at 25 feet, but much thinner, and as a result much lighter, weighing just 770 pounds. They eat primarily fish, but also eat crustaceans. They also have a shorter life span, at just 30 years.



CARCHARHINIFORMES

CARCHARHINUS LEUCAS

97

One of the most infamous sharks in the world, renowned for their aggression and having the highest testosterone levels in the animal kingdom, the Bull Shark. Bull Sharks are not actual freshwater sharks, though they are able to thrive in freshwater their entire lives. They are a wildly successful species, having one of the largest ranges of all sharks, from Massachusetts to southern Brazil. They do not have a preferred anything, ranging from deep streams, to 490 feet beneath the oceans surface. The only thing they seem to be concerned with is prey availability.

Bull Sharks ability to thrive in both fresh and saltwater is thanks to their ability to control salinity in their liver, kidney, rectal glands, and gills. They do this by decreasing the amount of salt excreted through their rectal gland. Bull Sharks, like all sharks, rays, and sawfish, have pores which detect electronic pulses in the water, helping them find prey in very turbid (cloudy) water. Also aiding in prey-location is their pressure sensitive pores, as well as acute sense of smell.

Bull Sharks typically take bony fish as prey, but will eat anything from birds, to turtles, to mammals, to other sharks, not excluding smaller Bull Sharks. They are also responsible for the overwhelming majority of shark attacks, and are one of two species known to eat humans after taking a bite. This might be due to their incredibly high testosterone levels, the highest recorded. To give perspective, a bull elephant's testosterone level only ever reaches roughly 60ng/ml, but the Bull Sharks is 358ng/ml; that's also about 9 times that of a lion. Human males testosterone levels never even reach 80ng/ml, even at the height of puberty.

The average Bull Shark is between 7 and 9 feet, and weighs between 200 and 400 pounds (0.1-0.2 tons), but are known to reach lengths 13 feet, and weigh a whopping 850 pounds (0.425 tons). They also have the strongest bite force of any shark, at 1,300 pounds of force.

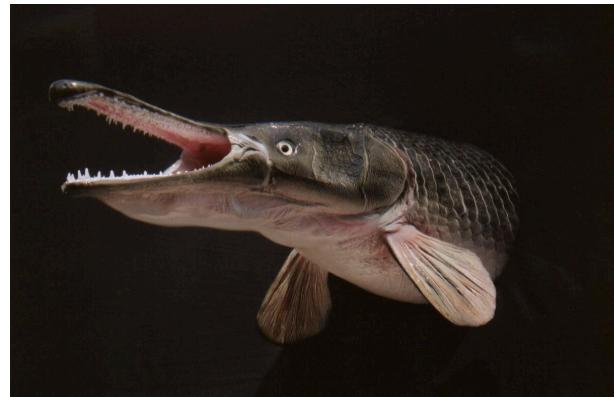


LEPIOSTEIFORMES

ATRACTOSTEUS SPATULA

98

Alligator Gar are rarely spoken of, are North America's largest exclusively freshwater fish, though they are known to frequent brackish estuaries as well as the mouths of rivers. They are also able to reach the Sturgeon's life expectancy of 60 to 80 years. The Alligator Gar is found throughout the Mississippi River system, as well as the Gulf Coast states, into northern Mexico. They prefer turbid, warm lakes and rivers. The largest individuals found in the mouths of rivers, and estuaries. To allow these giant fish to get the oxygen they need in warm (and consequently) lower oxygenated environments, their swim-bladder acts as a primitive lung, absorbing oxygen from the air, and can even survive for hours on land if kept wet.



Alligator Gar can reach a length of at 9ft 5 inches, and weighed 365 lbs placing them well above the Lake Sturgeon (see pg 36), and reports of 13 foot (~600lb, 0.3 tons) specimens from the 1800's until the 1980's. They regularly reach lengths of 6, and even over 7 feet and regularly weigh between 100 and 200 pounds (0.05-0.1). Even at such great sizes, gar are not known to eat fish larger than 2 feet. They are picky eaters, and will play with the food in their mouth for up to 20 minutes.

Now that we have the dimensions of this super-sized fish, lets get into more details on the fish itself. Gar are ancient, having existed for nearly as long as Alligators themselves, at about 70 million years before today. These fish have over time become incredibly streamlined, their giant tails and long, muscular torpedo-like bodies slip through the water effortlessly. The scales themselves deserve a special mention, they are made of enamel, the stuff that coats your teeth. The scales are so hard and sharp that native americans used to use them as arrowheads. If their speed and armor aren't enough to warrant the name "alligator gar", their teeth are. Alligator Gar's teeth can measure an inch long, and are very sharp, best for puncturing slick fish and not letting go.



LEPIOSTEUS OSSEUS

99

The Longnose Gar, the second oldest species on the list, having existed for nearly 100 million years. They are prolific everywhere east of the Rockies, found throughout the

Mississippi River system, down to the Rio Grande River basin, north into Quebec CA, and all the way to the East Coast, from Maine to Florida.

Longnose Gar are generalists, but prefer slow moving rivers, though they can be found in lakes and even lagoons, as they are able to tolerate brackish water. In the late spring and early summer they migrate to small, quick, clear streams to lay up to 77,000 eggs in.



This ancient fish can grow surprisingly large, reaching 55 pounds in weight and nearly 7 feet in length, though they usually reach between 5 and 20 pounds, and seldom break 5 feet in length. Longnose Gar are an ambush predator, gradually floating closer to their prey until they are close enough to whip their head to the side, grasping the prey item with their long mouth. They eat anything they can catch, from frogs, to invertebrates, other gar, to sunfish.

Longnose Gar, like their larger relatives, have scales made of enamel, giving them very impenetrable, and sharp armor which is still light. They also have the ability to use their swim bladder as a primitive lung, helping them survive oxygen depleted water which other predators can't survive. This, along with their flexible diet and versatile hunting strategy has allowed them to be so successful for so long. Male Longnose Gar become sexually mature by age 4, and females at age 6. They live for a maximum of "just" 30 years.



SILUIFORMES

ICTALURUS

100

A genus of large, American catfish. They are known to eat aquatic invertebrates, including crustaceans, mollusks, frogs, snakes, smaller fish (particularly wounded ones), and carcasses. Their breeding season is in the summer. They have a courtship and partners are paired off months in advance.

These catfish prefer warmer, deeper, slower moving rivers, impoundments, lakes and deeper marshes if they are connected to the aforementioned habitats. They have a tolerance for even brackish water, though prefer freshwater. They are often associated with gravel or sandy bottoms.

Catfish barbels are used to taste in a three dimensional way replacing sight as their dominant sense, as their preferred environment does not lend itself well to a visually-oriented lifestyle.

ICTALURUS FURCATUS

The Blue Catfish is North America's largest catfish, it grows to a length of 5.4 feet, and reaches a weight of 150 pounds, though there are multiple historic reports of 6.5 ft, 315 lb fish being caught before habitat destruction, pollution and trophy genetics being hunted out. They are common throughout the southeastern USA, throughout the Ohio, Mississippi, and Missouri river basins, into the Rio Grande, and ending in northern Guatemala.



ICTALURUS PUNCTATUS

Channel catfish are more northern than their sister taxa the Blue Cat, they are found from southern Canada to northern Mexico, and from the east coast to the west coast. They reach a maximum weight of 58 pounds, and a maximum length of 48 inches. They can live up to 40 years.

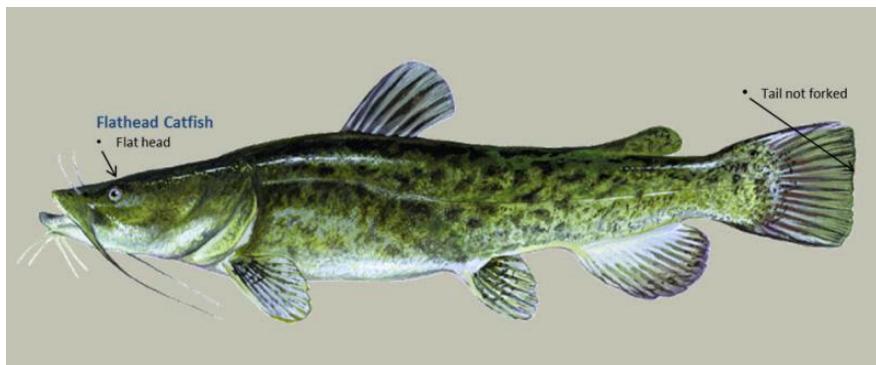
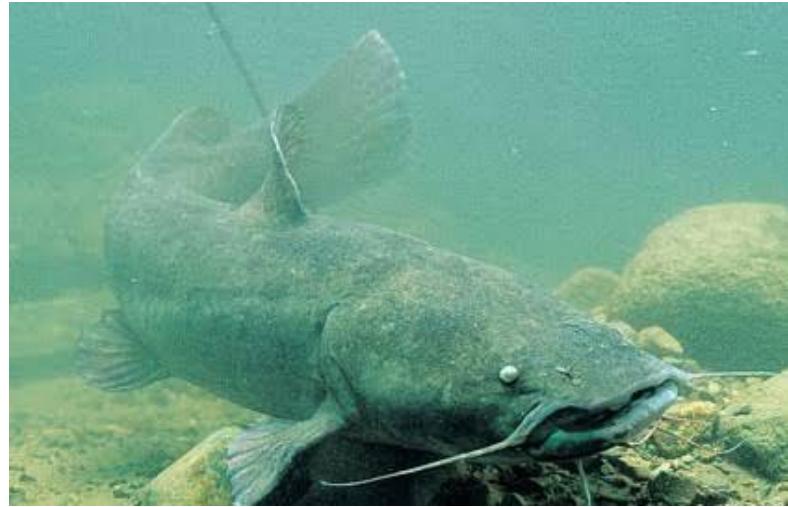


PYLODICTIS OLIVARIS

101

The Flathead Catfish, my favorite catfish. They are more of an active predator than their cousins, and nearly as large. Olivaris have a range from the southwestern shores of every great lake except Superior, then southwest to the southern side of the Rio Grande watershed. Their preferred habitat are slow, deep rivers with brush piles and snags for cover, especially during the day. At night they swim out to the deep parts of the main channel to hunt for prey who are blind at night, then they open their enormous jaws and suck their prey into their mouth, which creates a vacuum as it opens. Their jaws are lined with small sandpaper-like teeth, and extremely powerful which helps crush and kill their prey.

Flathead Catfish are shaped like a reef shark, and they function as one. They are an obtuse triangular, whose mouth opens wider than their body. They are relatively flexible with their diet, eating insects, crustaceans, worms, fish, muskrats, ducklings, and anything else in or swimming across deep channels. Their whiskers, or barbels help them smell in 3 dimensions; their lateral line enables them to sense pressure in 3 dimensions, allowing them to dominate the night and murky waters of North America where sight predators can't function. Olivaris grows up to 70 inches in length and can weigh up to 139lb.



salmoniformes

102

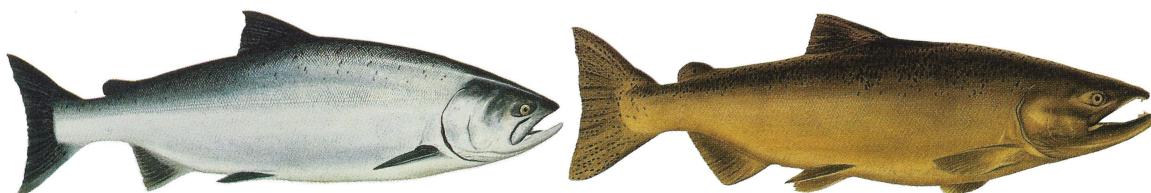
oncorhynchus

Oncorhynchus are characterized by their long migrations to lay eggs where they spawned from. After the adults spawn, they die which fertilizes the river and feeds the local predators who are less likely to eat the salmon alevin (salmon fry when they hatch still have a yolk attached to them which they feed on for 2 weeks before becoming mobile and eating zooplankton).

oncorhynchus tshawytscha

Also known as the Chinook Salmon, spend three to eight years of their lives in saltwater, and come into freshwater rivers to lay eggs, and then die. They reach sizes of up to five feet in length and weigh as much as 126 pounds, and provided an essential source of fats for the animals of the pacific northwest, making the longest migration of any fish from july to august up the pacific rivers, going over 1,000 miles to spawn and die to fertilize the river for their offspring. In the ocean, they have needle-like teeth to which grip small fish scales and skin.

(Left adult ocean phase, right breeding freshwater phase, Chinook)



oncorhynchus mykiss

Rainbow trout, the common name for mykiss. Indiginous to the western United States, these strong swimming fish also travel long distances to reach their breeding grounds. Indiginous eat small fish and invertebrates swimming in the ocean and along the coast. They are an essential trophic level, being food for larger fish and filling the rivers with their bodies, supercharging the ecosystem for their offspring's arrival, and satiating most predators appetites, protecting the vulnerable eggs.

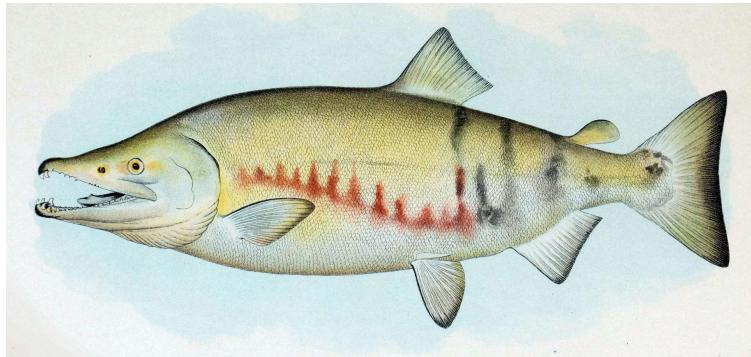


ONCORHYNCHUS KETA

103

Keta, also known as the Chum Salmon, is a species of pacific salmon which can grow to be 42 lb and 44 inches in length. They also make the long journey upstream to spawn, where they then die. They prefer colder waters and were more prolific during the ice age.

(breeding freshwater phase)



Salmo Salar

The Atlantic Salmon, a very similar lifestyle, but a separate genus from the pacific salmon, separating between 7 and 23 million years ago, originating somewhere near the rockies. Salar is found throughout the north atlantic, from Virginia, north to southern Greenland and then southeast to Spain. This salmon is one of the largest salmon in the world, weighing up to 109 pounds and up to five feet in length. Salar prefer as an adult hunts smaller fish, generally preferring smelt. They are also more aggressive than most salmoniformes, especially in their range making them less likely to school than others of their family (except during spawn when the adults migrate upstream). As juveniles, salar will stay in the rivers they hatched in and will stay in them from 1 to 8 years, depending on climate. In colder rivers they wait longer and the inverse is true in warmer climates. Once they move into the ocean, they grow rapidly for 1-4 years before turning into their final form and becoming ready to return to freshwater to spawn.

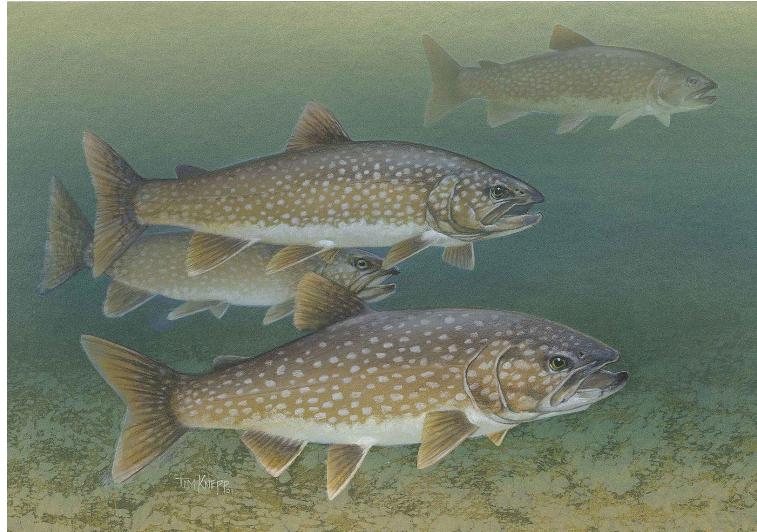


SALVELINUS NAMAYCUSH

104

The Lake Trout, in the charr genus, within the same subfamily as the Atlantic and Pacific salmon. This fish species does not migrate, staying within the largest, deepest, and coldest kettle lakes in the center of the continent of North America. Namaycush prefer cold, deep lakes which have a higher dissolved oxygen content. They are often found as deep as 200 feet.

Because this ecosystem is so new, they have been able to fill new niches, diversifying into two different lifestyles. One of which is planktivorous matures slowly, doesn't get large, and another which is piscivorous and is able to grow larger, faster. This ability is due to environmental pressures and not true genetic divergence. Namaycush can grow up to 82 pounds and be over 60 inches in length, making it the largest species in its genus.



SALVELINUS CONFLUENTUS

Also known as the bull trout, is a species of fish from the north west. They prefer extreme cold of melt waters, and sometimes as adults come to the ocean between spawns, where the largest specimens live. *Confluentus* is extremely energetic, this is important because they need to keep up with the speed of the water they're in. They are also piscivorous and can be highly aggressive towards other fish, making them successful predators. *Confluentus* can grow to be 41 inches in length and 32 pounds, and have larger teeth than most adult non-spawn salmoninae (genus *salmo*, *oncorhynchus*, *salvelinus*).

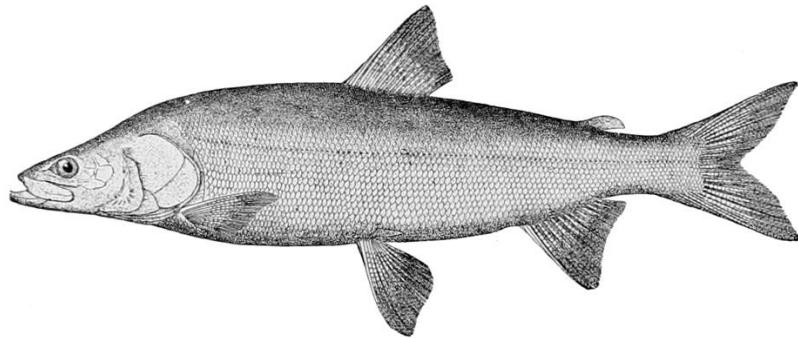


coregoninae

105

STENODUS NELMA

The largest species of whitefish, the Nelma reaches up to 60 inches in length and 60 pounds in weight. In order for this fish to reach these sizes, it had to stay in extremely cold water. The nemla is found along the northern pacific coast primarily. The nemla spawns are restricted to the coldest tributaries to rivers before migrating to the estuaries and bays to overwinter as adults. They are aggressive piscivorous eaters, hunting any smaller fish unlucky enough to be in the line of sight, even smaller Nelma. They do not have large teeth like the salmoninae, but are still very successful throughout their range.



COREGONUS CLUPEIFORMIS

Clupeaformis's common name is Lake Whitefish. They are benthic feeders, as adults eating snails and clams and as young eating zooplankton. Clupeaformis prefer the bottoms of deep cold lakes being found as deep as 2,000 feet when the body of water permits. They are common throughout the larger oligotrophic lakes throughout the holarctic of North America. These fish tend to school in larger bodies of water. Clupeaformis can reach 42lb and likely around 48 inches in length. During spawn, a female can lay as many as 130,000 eggs at a time, depending on size. Clupeaformis stay in shallow waters to spawn and wait until temperatures are below 45° F.



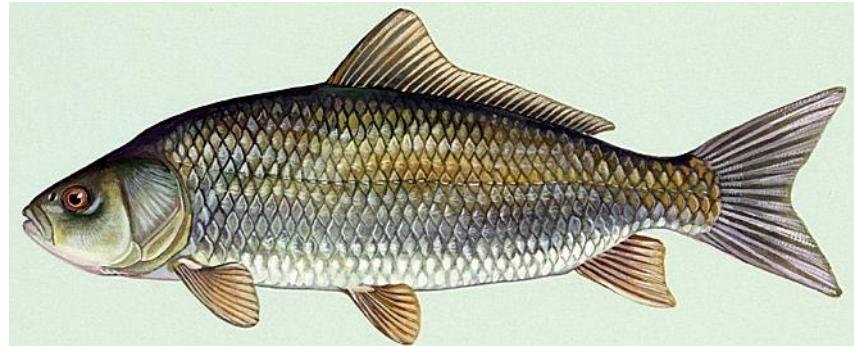
Lake Whitefish
Coregonus clupeaformis

CYPRINIFORMES

ICTIOBUS

106

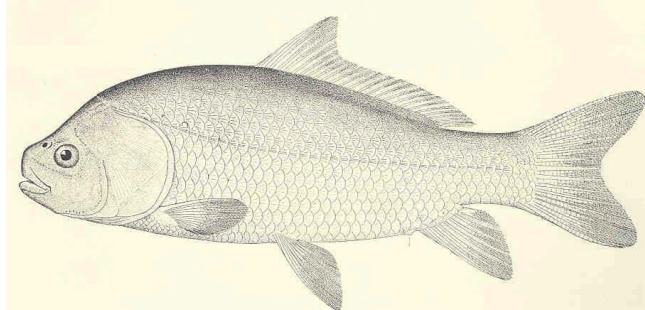
A common prey fish for the larger predators in the river and lake systems. Though this list will only cover the largest species, there are hundreds of species throughout the entire continent that are too small to be on the list but are keystone species for all freshwater ecosystems on the continent, even in caves.



They have fewer defences, relying primarily on numbers and their adult size. To be the largest fish in the pond, they are often found in smaller bodies of water than the larger salmoniformes and lepisosteiformes. They are slower than the salmoniformes and esociformes, because they are found in warmer waters and eat less nutrient rich foods. These fish are not closely related to carp, which are a new species brought over from Asia Minor in the 1800's.

ICTIOBUS BUBALUS

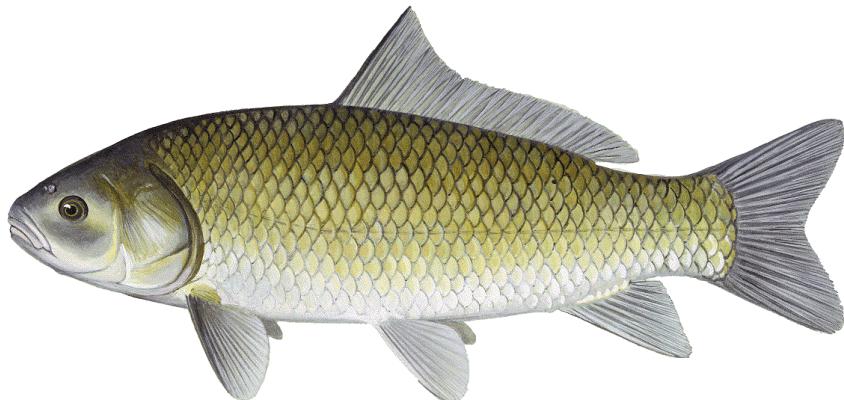
Ictiobus Bubalus, common name Smallmouth Buffalo. Bubalus prefers warmer waters, staying more to the south during the Pleistocene. They feed primarily on detritus, keeping their heads low to the river beds as they feed. Bubalus is found in faster flowing water than other large cypriniformes. Bubalus reaches sexual maturity at about 18 inches and can grow to 102 pounds and over 60 inches. The suckerfish from this genus likely diverged from each other within the last 5 million years, somewhere near the rocky mountains.



ICTIOBUS CYPRINELLUS

107

The Bigmouth Buffalo, the longest living minnow in the world, reached their physical peak at 110 years of age, no one knows their maximum age. Their average age has been measured to be between 80 and 90 years old. These are a common species throughout the Mississippi river basin, and east through the southern Atlantic coast and west to the rockies. Cyprinellus can reach 80 pounds and 50 inches in length, however they are more regularly between 15 and 30. As larvae, they feed on



zooplankton benthics, as adults they are filter feeders, with specially adapted gill rakers which collect zooplankton and algae. Cyprinellus can tolerate high turbidity, and low dissolved oxygen, living in eutrophic and mesotrophic rivers of the

American South. This niche is shared with the paddlefish, *Polyodon Spathula*.

ICTIOBUS NIGER

The Black Buffalo, the smallest and most northerly of the ictiobus genus, found into canada, and south to texas. They grow to 80 pounds and close to 5 feet, though they generally don't reach above 25 pounds and 30 inches. Niger primarily feeds on benthic invertebrates and detritus like old berries which wash into the rivers. They prefer smaller rivers and streams than their larger cousins, staying in clearer waters than their



southern cousins. Niger also likes clearer water, with more dissolved oxygen which likely aids them in wintering farther north, as well as in smaller headwaters which tend to be faster and cooler.

ESOCIFORMES

ESOX

108

The genus esox evolved during the upper cretaceous, more than 66 million years ago, surviving the K-T event which wiped out the dinosaurs. They have fine-tuned themselves to be excellent predators, having grooves on their snout which act as a sight for them to line up and lunge at their prey, before they lunge at it, opening their mouth to create a vacuum which sucks the fish in whole, where their large teeth can kill the prey item.



Esox can be found in any body of water which stays below 65 degrees fahrenheit, and preferable significantly beneath, as they are found into Northern Alaska. They inhabit oligotrophic and mesotrophic lakes, rivers and streams with high dissolved oxygen and an adequate prey population. Their scales don't provide as much protection

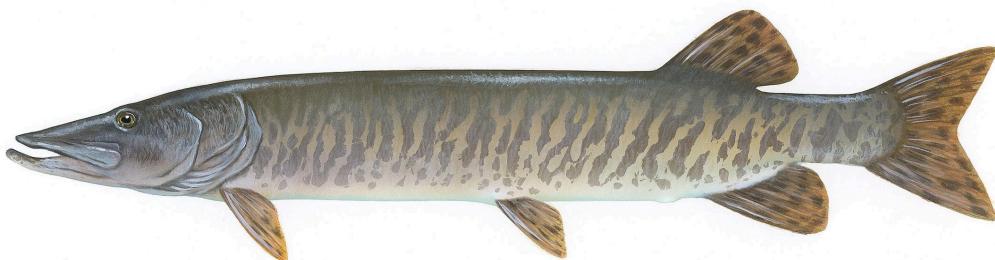
as many other fish, making them easy prey as juveniles. As adults, they are usually too large to fall victim to predation from other fish and piscivorous raptors, and too fast and deep to fall victim to land based predators.



ESOX MASQUINONGY

109

Masquinongy, also known as the Muskie or Muskellunge. They grow to 6 or 8 feet in length and can weigh up to either 70 or 120 pounds. Masquinongy reach sexual maturity at 40 inches in length, and grow their entire lives. At this size, they have no natural predators. Their teeth can reach over an inch in length, and they have dozens. They prefer larger bodies of water than their cousins, and function almost like an open water shark, chasing smaller, slower prey and blasting through it with their well equipped mouths. Masquinongy hunts everything from fish to birds and crossing land animals, including snakes, rabbits and muskrats.



ESOX LUCIUS

Lucius, or the Northern Pike is a species of fish found around the holarctic, famous for their ferocity and adaptability. They are common in all cold rivers and lakes throughout their range, except for the fastest rivers and the pelagic zones of the largest lakes. They reach sexual maturity at around 2.5 pounds and between 18 to 24 inches, but can grow for decades to reach sizes up to 70 pounds and 5 feet. Lucius also has incredible teeth, much like its larger cousin.

Lucius hunts all the same prey once they reach 36 inches, capable of striking at waterfowl and small mammals. They are primarily piscivorous, eating sunfish and small cypriniformes. Lucius prefers smaller bodies of water than their cousins, and prefers weed beds which provide cover for them to burst out of, jaws open to snatch prey with their sharp recurved teeth.



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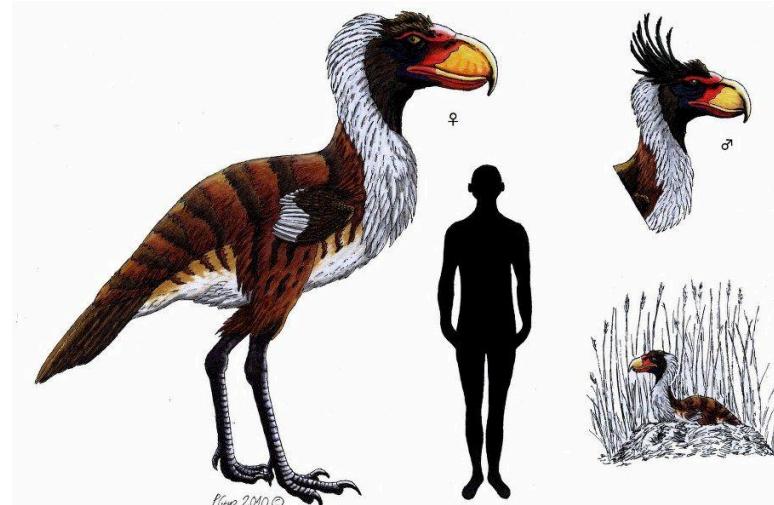
cariamiiformes

TITANIS WALLERI

113

North America's one and only true Terror Bird, invading the plains from the newly connected Panama land bridge to put more ecological pressure on the plains undoubtedly causing truly incredible clashes. Walleri evolved during the miocene, coming into existence during the beginning of the Pliocene, 5 million years ago in South America. When the continents met, these were the apex predators in South America at the time. Walleri pressed north after the great american exchange, existing for another 500,000 years until 1.8 myo with competition from large carnivora from North America and Eurasian invaders.

Walleri could reach just over eight feet tall, and weigh as much as 440lb. Their primary killing method is a fatal blow to the spine dealt by their beak. Their head could be over 20 inches in large individuals, giving it the mass needed to have enough force to break the bone of whatever prey animal they were striking. They were fast, capable of reaching up to 40 mph. Walleri's legs were a significant weak point, putting their center of mass so high from the ground made them significantly less agile. Walleri's legs could also be used as deadly weapons, used to kick with their giant claws, probably hitting at least as hard as an Ostrich, which has a 2,000 pounds of force in their kick



CATHARTIFORMES

TERATORNITHIDAE

114

New world vultures, the heaviest flying animals since the dinosaurs, evolving 32 million years after the dinosaurs in South America, then spreading to the New World during the pliocene, before diversifying into several species.

Teratornithidae are all scavengers, relying on their eyesight to track other scavengers and sight the corpses of megafauna on the ground. Their large nasal opening likely allowed them to have a sense of smell. Teratornithidae had larger, more robust heads which could have been used to hunt, or could have been useful in opening thick hides of Pleistocene megafauna.

(*teratornis merriami*
right)



AIOLORNIS INCREDIBILIS

The largest bird ever to grace North American skies, with a wingspan of up to 18 feet and a weight of up to 55 pounds. *Incredibilis* were built to soar with a wingspan this large, likely helping them cover enough ground to find enough carrion to sustain such an enormous bird. At this size, *Incredibilis* would have likely targeted animals at least 2 tons in mass, where their enormous beak would be a huge advantage against giant ungulates, proboscidea folivora, and perissodactyl tough hide. They were found in the southwest and western central US.



Aiolornis incredibilis (*Teratornis incredibilis*)

TERATORNIS WOODBURNENSIS

115

Woodburnensis was found through more northern states, though it was found in the south, just to a lesser degree. They were much more common than their largest North American relative, but still much larger than anything flying today. They weighed up to 38 pounds, had a wingspan of up to 14 feet, and could stand just over 3 feet tall. It would have filled a similar ecological niche to *incredibilis*, however it was likely more adaptable due to lower caloric requirements due to its smaller size; this also would have made getting airborne easier. *Woodburnensis* evolved about 2.5 million years ago.



TERATORNIS MERRIAMI

Merriami is *woodburnensis*'s closest relative, separating 2.5 million years ago into northern and southern populations. *Merriami* was significantly smaller, with a wingspan at 'just 12.5 ft' and a maximum weight of 33 pounds. Both *Merriami* and *Woodburnensis* died out during the Younger Dryas, roughly 11 thousand years ago.



CATHARTIDAE

GYMNOGYPS AMPLUS

Also known as the California Condor, evolving into the California Condor at the end of the ice age, was another species of giant vulture which could only exist with the enormous megafauna. *Amplus* likely had a wingspan of 13 feet, and weighed just over 33 pounds. *Amplus* had a subspecies or an extremely close relative in the West Indies, of a similar size. *Amplus* likely had a weaker sense of smell than other vultures.



Anseriformes

CYGNUS

116

Swans, a beautiful, extremely successful branch of the anseriformes, evolving in the late Miocene, more than 5 million years ago in Europe. From there, Cygnus spread throughout the Northern hemisphere until the end of the Pliocene, when they began to be isolated enough for genetic drift, ecological and sexual pressures to separate Cygnus into individual species. There were likely multiple waves of Cygnus which spread throughout the world, leaving several different populations with unique adaptations due to ecological pressures. Cygnus is found in South America, Australia, as well as North America and Eurasia where it originated.

Cygnus are herbivorous, feeding on water plants and algae. To find this food, they have larger uropygial glands which secrete a waterproofing oil from the base of their tail, all aves have this gland but aquatic abd semi-aquatic aves have larger and more active glands. Cygnus also have webbed feet, a trait common amongst the entire anseriformes order. They also have lamellae, small tooth-like structures made out of their beak which they use to cut plants. Cygnus mate for life in monogamous couples, and live for over 20 years. They generally stay in their pairs, only forming larger groups to be more aerodynamically efficient when migrating thousands of miles to and from their winter and summer homes.



(*Cygnus columbianus* left, *cygnus buccinator* right)

CYGNUS BUCCINATOR

117

The Trumpeter Swan, the most graceful of the titanic Pleistocene aves. Buccinator was found across the forested North of the continent. As adults, Buccinator was too large to be hunted by the fish of the pleistocene. However, they did face many threats ashore. Buccinator's ability to fly is essential to their ability to survive predation. Buccinator migrates less than 1,500 miles, generally.

Buccinator has a wingspan of up to 10 feet and 38 pounds, though they more commonly weigh between 15 and 28 pounds. Their wingspan is also generally between 6 and 8 feet. Buccinator can reach up to 6 feet in length in the largest individuals, but more regularly measure to between 4 and a half to five and a half feet in length.



CYGNUS COLUMBIANUS

Also known as the Tundra Swan, Columbianus is significantly smaller than its cousin, Buccinator. Columbianus is found in and around the extreme northern latitudes, anything which still has freshwater weeds for some of the year. Columbianus migrates up to 2,000 miles twice a year.

Columbianus can weigh between 7 and 21 pounds, have a wingspan of between 5 and 7 feet, and measure between 3 and a half to 5 feet in length. Columbianus is the closest relative to Buccinator, however the South American Swan is the furthest related to all American swans.



BRANTA CANADENSIS

118

More commonly known as the Canadian Goose, *canadensis* is the largest species of goose native to North America. Likely one of the most common and most well known species on this list. During the Pleistocene, they were relatively common throughout the lower 48 and into Mexico. *Canadensis* was common on river banks with open wetland or grassland on shore, which allows them to see predators from further away. However, they were small enough to be an important food source for small and medium predators across the continent.



Canadensis can grow to be nearly the size of a *Cygnus*, at 24 pounds, though usually half that weight, generally between 5 and 14 pounds. *Canadensis* has been so successful that it has diverged into at least 7 different populations with measurable differences in morphology, leading to a very wide variety of sizes. Their wingspan can measure anywhere from 4 to 7 feet, as is expected with such diversity.

BRANTA HUTCHINSII

Also known as the Cackling Goose, *Hutchinsii* can grow to 7 pounds. *Hutchinsii*, like *Canadensis*, migrates south for the winter, traveling hundreds or thousands of miles each season to stay within their preferred temperature range. *Hutchinsii* also prefers shallow, permanent bodies of water with grassland and or shrubs to hide in. *Hutchinsii* likely diverged from *Canadensis* during the Pleistocene. There are many other smaller species of *branta* which make up an essential part of their ecosystem, being an important source of prey in the spring as things heat up for the summer.



ANSER ALBIFRONS

119

Also known as the Greater White-Fronted Goose, Albifrons is a migrator, summering in the north, on the edge of glaciers, and in the winter staying on the gulf coast and Mississippi river channel to escape the biting cold; that's about 2,500 miles every 6 months.

Again, these anseriformes are easy prey for the incredible menagerie of capable predators throughout their entire range.

Albifrons can weigh between 4 and 7 pounds and have a wingspan between 4 and 5.5 feet. Males are generally larger than females. They measure 2 to 3 feet in length.



CHEN CAERULESCENS

Better known as the Snow Goose, caerulescens spends its summer breeding on the melting snowpacks to escape the extreme competition of the more southern latitudes. This allows them to avoid the worst predators while they are exposed, protecting their nests. Then, as adults caerulescens go south to the southern, greener, more dangerous pastures.



Caerulescens can grow to 10 pounds, though they are usually between 4 and 6 pounds. Their wingspan measures between 4.5 and 5.5 feet. Like all birds, caerulescens has an oil gland above their tail feathers which produces oil which waterproofs their feathers, though on non-aquatic birds these glands are less active.

Meleagris

120

The turkey, one of America's most common and beautiful birds. Meleagris are large, primarily terrestrial birds, which are omnivorous. Because of their varied diet, they have been able to adapt to numerous biomes throughout a wide variety of temperature range.

Meleagris evolved on the continent of North America 23 million years ago. Meleagris has been widespread for its entire fossil record, initially being found between Nebraska and Florida, but eventually spreading to dominate South and Central America. Male meleagris have caruncles and snood, which inflate with blood to expose blue pigment, and elongate to try and scare rivals and impress the females during mating season. I believe meleagris's extreme sexually dimorphic display adaptations could be designed to disadvantage them, which were sexually selected for and can be easily bred out. Their extremely visible coloration and small size makes them an easy target for all predators. Meleagris has to do this, because they would likely over-use the resources which support them, and then they would burn through their food supply and have major population collapses, so in the way of population control their sexually selected high-visibility coloration makes ecological sense. Meleagris are social, forming groups of females with males competing with each other to see who can get breeding rights to the flock. Melagris have large spurs on their feet which they use to defend and attack. Their toes also have claws, but not nearly as large as their spurs.



(Meleagris Ocellata left, meleagris Gallopavo

MELEAGRIS GALLOPAVO

121

The Wild Turkey, one of the most successful birds on the continent, found throughout the entirety of the lower 48, and in the south gallopavo is supplanted by its more ornate cousin. Gallopavo hen's weigh between 6 and 12 pounds, and the toms weigh between 11 and 25 pounds. However, the largest tom weighed 38 pounds. Tom's have much more ornate coloration, to attract mates and to intimidate other tom's. They nest on the ground and roost in trees. Gallopavo are omnivorous, eating everything from small snakes to leaves, roots and grasses.



MELEAGRIS OCCELLATA

A truly beautiful bird, which goes by Ocellated turkey to the laymen, these birds are found in the Yucatan peninsula. Ocellata are significantly smaller than their northern cousins, only attaining 20 pounds in toms and averaging 11 pounds. The female Ocellata reach about 11 pounds but average closer to 7. Like their northern cousin they have an extremely varied diet which enables them to be successful in spite of their lack of camouflage.



CENTROERCUS UROPHASIANUS

Also known as the Greater Sage-grouse, found throughout the central plains, the largest representative of the Grouse in North America. They are more insectivorous than their larger more forest dwelling cousins, hunting in the meadows and returning to the bush to hide from airborne predators and fast moving terrestrial predators. Unlike Meleagris, Urophasianus doesn't have the same snood, wattle and caruncles. Instead they have yellow eyebrows and two sacs on their lower neck which they inflate during mating rituals.



PELECANIFORMES

PELECANUS

122

Pelicans are an extremely successful group of birds which evolved during the oligocene, about 30 million years ago in Egypt, in what was once the Tethys Sea, a tropical and extremely shallow sea, dotted with high weather-worn peaks, possibly useful as nesting grounds. They are amphibious, but are phenomenal fliers, capable of traveling hundreds of miles in search of fishing. Pelicans do not migrate, however they

do congregate at their nesting colonies. Outside of these colonies and child rearing, they are solitary animals.



(*Pelecanus Erythrorhynchos* center, right center left;
Pelecanus occidentalis center, far left, far right)

Pelicans preferred prey are fish, which they will dive, and scim the water to catch. They have to swallow all their food whole, as they have no lateral movement to their beak, and not enough rigidity in their bill to effectively crush or cut. In response, pelicans throats are also more elastic than most other aves, which creates a large pouch for them to hold food in, and allows them to maneuver larger prey items into their throat, decreasing the likelihood of choking. Like other semi-aquatic aves, they use their uropygial gland's oil to protect their feathers from salt and water damage, so it is larger and more active than terrestrial aves. They are not territorial, and will dive into the water in waves, while teaming up with undersea predators, to keep the prey confined and easy to attack.

PELICANUS ERYTHRORHYNCHUS

123

Common name, American White Pelican, *erythrorhynchus* is found in most temperate and all subtropics of North America, preferring saline water, but capable of living in fresh. They are the largest species of Pelican, and the largest wingspan outside of the teratornithidae family (condor's). The largest *erythrorhynchus* grow to 30 pounds in weight, and have a wingspan of nearly 10 feet. Those are the largest individuals, most weigh between 11 and 20 pounds, and have a wingspan between 6.6 ft and 8 ft.

Erythrorhynchus stand tall for soaring birds, at almost 4 feet tall in the largest, and closer around 3 feet for most others.



PELICANUS OCCIDENTALIS

Better known as the Brown Pelican, the smaller, more marine cousin to *erythrorhynchus*. Found in all temperate and subtropical regions, they are very successful. Likely because they

are more agile, and efficient gliders, because they are smaller at a maximum weight of 14 pounds, and an average weight between 4.5 to 11 pounds, averaging 7 pounds in females and 8.2 pounds in males.

Occidentalis has a wingspan which ranges from 6.5 to 8 feet. Males perform a display of head movement in front of the nest they have constructed, in an attempt to woo a female. The pair of *occidentalis* are monogamous during the breeding season but do not pair for life.



ARDEA HERODIAS

124

Better known as the Great Blue Heron, Herodias had a common ancestor from eurasia which diverged from other herons around 7 million years ago and fully separated from its type-species in North America during the first half of the Pleistocene. Herodias are found throughout all water bodies in all biomes south of the tundra. They migrate from where the water freezes to overwinter, sometimes lying over a thousand miles. Herodias breed in what are called rookeries, a tree or small group of trees bordering their favorite body of water. The males begin nest building, often choosing to add to existing nests of crows or other smaller birds. Herodias pair for the season, not for life and their life span can be up to 15 years. They lay 2-7 eggs, after they hatch they raise their young for 40-80 days in the nest and 2-3 weeks around the rookery. Herodias are found in shallow water whether it's moving, the edge of a huge body of water, or a still seasonal body of water. Herodias will move their bodies with the reeds to help them disappear into the reeds. They are hunters, using stealth, their long S shaped neck and lightning fast reflexes to spear prey with their sharp bill. Herodias take everything from small mammals like voles and shrews, reptiles, amphibians, as well as all species of small fish. Herons make prey for larger birds of prey, as well as large amphibious reptiles like alligators and large snakes

Herodias is one of the tallest birds in North America, standing up to 4 and a half feet tall, however their wingspan is less than half the largest of the Pleistocene, at a mere 7 ft. They can weigh up to 8 pounds, though they average 6 pounds for sexually mature adults.



ACCIPITRIFORMES

ACCIPITRIDAE

AQUILA CHRYSÆTOS

125

They patrol the sky searching for prey and rivals to expel from their territory (which can be just 0.12 to 200 sq. miles). Ranging from 10,000 ft above sea level, to 200 feet below, in Death Valley. Their versatility is best illustrated in their range of habitats, from the rocky and alpine cliffs of the Rockies, to the plains.

Chrysaetos can weigh up to 27 lbs making them the heaviest accipitriforme on the continent; the average eagle will weigh from 7 to 20 lbs (with females averaging 30% larger than males). A larger subspecies of Chrysaetos existed during the Pleistocene, which weighed up to 20 pounds with more regularity. Their wingspan is large, at 6 to 8 and sometimes even 9 feet. Their wings are broad, as well to help them rise on thermals when they're available, while keeping the wings slightly shorter to help with more restricted spaces.



Chrysaetos have large tails to allow for greater maneuverability, making them up to three feet long. They have a wedge shaped tail, which they have expert control of, enabling them to maneuver through forests, and add supplementary lift in tight spaces. Chrysaetos have very long legs and at the end, they have massive feet. Each of the four main toes are equipped with talons at the end, these talons reach up to 3 inches and are capable of closing them with up to 440 lbs for a 9 lbs eagle or 49 times the eagle's weight, potentially more depending on the size of the eagle. This in and of itself is quite a dangerous attack, but you also have to factor in the eagle dives, and can reach speeds of up to 150 mph. These capabilities put Chrysaetos atop the food chain, preying on everything from mice to 200lb bighorn sheep, including coyotes, and 45lb lynx.



Chrysaetos wings are powerful enough for a 12 lb eagle to fly away with an Alpine Ibex, which weighs nearly four times the eagles weight, at 40 lb. That is rarely achieved in humans, on the ground. A 160 lb man would have to lift 600lb. This enables them to keep more kills from scavengers, because they can fly with their prey.

